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Bibliography

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Epitome

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(57) [Abstract]
[Technical problem] When a refrigerant with high working pressure is used, it is necessary to raise the pressure resistance of refrigerant circuit components and, and the problem of the increase of cost by exchange of established piping and the increment in trash occurs in the complicated large-sized building of a piping path.
[Means for Solution] The refrigerant circuit which comes to connect a compressor 1, heat-source side main heat exchanger 2a, heat-source side auxiliary heat exchanger 2b, the flow rate control units 3a and 3b, and the use side heat exchangers 4a and 4b for piping, It had the solenoid valves 27 and 28 to which the closedown of the circulation of the refrigerant to heat-source side auxiliary heat exchanger 2b is carried out, the pressure sensor 20 which detects the condensation pressure of heat-source side main heat exchanger 2a, and the operation control section 19 which carries out closing motion control of the solenoid valves 27 and 28 according to the pressure detected with the pressure sensor 20.

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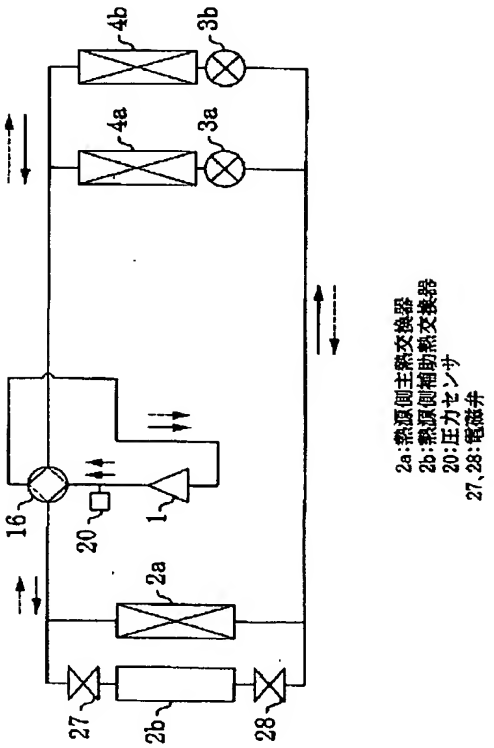

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CLAIMS

[Claim(s)]

[Claim 1] The control approach of the refrigerant circuit characterized by to control condensation capacity so that the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant and the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[Claim 2] The control approach of the refrigerant circuit characterized by to control the evaporative-power force so that the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor , a condenser , a diaphragm means , and an evaporator for sequential piping is transposed to a high pressure refrigerant and the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement .

[Claim 3] The exchange approach of the refrigerant circuit characterized by to exchange for the condenser of capacity with which the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant, and the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[Claim 4] The exchange approach of the refrigerant circuit characterized by to exchange for the evaporator in which a displacement control is possible so that the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping may be transposed to a high pressure refrigerant and the saturation pressure in the refrigerant circuit by the refrigerant after replacement may become below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[Claim 5] The exchange approach of the refrigerant circuit characterized by to exchange for the control means which carries out pressure control so that the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping may be transposed to a high pressure refrigerant and the saturation pressure in the refrigerant circuit by the refrigerant after replacement may become below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[Claim 6] Refrigerant circuit equipment characterized by being constituted by claim 3 thru/or any 1 term of 5 through the exchange approach of the refrigerant circuit a publication.

[Claim 7] Refrigerant circuit equipment characterized by providing the following. The refrigerant circuit which comes to connect a compressor, the first condenser, the second condenser, a diaphragm means, and an evaporator for sequential piping The closing motion means to which the closedown of the circulation of the refrigerant to said second condenser is carried out A temperature detection means to detect the condensation temperature of a pressure detection means to detect the condensation pressure of said first condenser, or said first condenser The control means which carries out closing motion control of said closing motion means according to the temperature detected with the pressure detected with said pressure detection means, or said temperature detection means

[Claim 8] Refrigerant circuit equipment according to claim 7 characterized by using the second condenser as a water cooling type condenser.

[Claim 9] Refrigerant circuit equipment according to claim 7 characterized by using the second condenser as a cold energy heat storage tank.

[Claim 10] Refrigerant circuit equipment according to claim 7 with which the second condenser has the evaporator of other refrigerant circuits, and is characterized by heat exchange being mutually possible.

[Claim 11] The refrigerant circuit equipment characterized by to have the refrigerant circuit which comes to

connect the evaporator arranged at a compressor, a condenser, a diaphragm means, and two or more juxtaposition for sequential piping, [redacted]essure detection means detect the co[redacted]nsation pressure of said condenser, and the control means to which two or more of said part or all evaporative-power force of an evaporator is reduced when the pressure detected with said pressure detection means exceeds a predetermined value.

[Claim 12] Refrigerant circuit equipment given in claim 7 thru/or any of 11 they are. [which is characterized by for the refrigerants to be used being refrigerants other than R22 or R407C, and the saturation pressure in the same temperature being the refrigerant which has pressure characteristics higher than any of R22 or R407C]

[Claim 13] Refrigerant circuit equipment which the refrigerant circuit which comes to connect two or more compressors and condensers, a diaphragm means, and an evaporator for sequential piping, and the refrigerant to be used are except R22 and R407C, and is characterized by to have said control means which made possible two or more operation controls of the compressor of a base according to the individual when using the refrigerant in which the saturation pressure to the temperature of arbitration has a saturation-pressure property higher than either a refrigerant R22 or refrigerant R407C.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to refrigerant circuit equipments using a refrigerant with high working pressure, such as an air conditioner and a refrigerator.

[0002]

[Description of the Prior Art] It has the multi-type air conditioner which can operate two or more interior units according to coincidence or an individual in many cases that two or more rooms should be air-conditioned according to an individual, and piping of piping length which leads to an interior unit from heat souce is also long, and bending and branching are needed on the way in an office, A piping configuration is also complicated. In the conventional air conditioner, R22 refrigerant of a HCFC system is mainly used and the components which constitute a refrigerant circuit had become the specification from which the reinforcement is secured according to the working pressure of a use refrigerant. However, in the refrigerant which was being used conventionally, a not desirable thing exists on earth environmental preservation, and, for this reason, the change to an alternative refrigerant is advanced. And since it says that R22 and pressure characteristics are alike in the case of a HVAC system with a comparatively large scale, R407C of a HFC system may be used as an alternative refrigerant.

[0003]

[Problem(s) to be Solved by the Invention] The effectiveness as a refrigerating cycle is gathered and it is possible to use a refrigerant with high working pressure highly [a consistency] that is, at the same temperature to reduce energy expenditure power. This is because it is expected that the rate of flow in piping will fall and pressure loss will also decline from the fall of a volumetric flow rate to the same mass flow rate according to a consistency being high. Since the pressure characteristics of R407c are R22 and abbreviation identitas, the engine performance is similar with R22. Therefore, compared with the case where R22 is used, big energy-saving nature is not expectable.

[0004] Since there are some alternative refrigerants to which the working pressure (saturation pressure) in the same temperature becomes high compared with R22 or an R407C refrigerant, while use of such a refrigerant

leads to energy saving Since the need of raising the pressure resistance of a refrigerant circuit component part corresponding to the rise of s[redacted]working pressure comes out, the case[redacted]ere it leads to the cost rise of an air conditioner occurs.,

[0005] Moreover, after R22 is used, long years have already passed, and exchange of heat souce and an interior unit may be performed with superannuation of the product with which it was equipped conventionally. If it is going to use the high product corresponding to an alternative refrigerant of working pressure in such a case compared with a refrigerant conventionally, and it remains as it is, heat souce and not only an interior unit but the need of also changing piping into thick thick piping the middle will occur. Since the large air conditioner of maximum capacity is installed in a comparatively big building, even if the number of interior units is one, when piping length becomes long and there is the bending section on the way, exchange of the piping is difficult. Moreover, in the system which has two or more interior units in one refrigerant circuit, since it has a part for the tee for every interior unit in the middle of piping, it is a complicated configuration and great costs are needed for replacing the large piping system of a scale. The energy expenditure for conveyance of not only economic impact but the trash of established piping generated from a large-sized building, abandonment processing, and playback is needed, and exchange of such established piping has a bad influence on earth environmental preservation.

[0006] It was made in order that this invention might solve the above technical problems, and even if the pressure resistance of the components which constitute a refrigerant circuit is low, it aims at making it possible to use a refrigerant with big working pressure.

[0007]

[Means for Solving the Problem] The control approach of the refrigerant circuit concerning this invention transposes the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping to a high pressure refrigerant, and it controls condensation capacity so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[0008] Moreover, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant, and the evaporative power force is controlled so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[0009] Moreover, the exchange approach of the refrigerant circuit concerning this invention transposes the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping to a high pressure refrigerant, and exchanges it for the condenser of capacity with which the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[0010] Moreover, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant, and it exchanges for the evaporator in which a displacement control is possible so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement may become below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[0011] Moreover, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant, and it exchanges for the control means which carries out pressure control so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement may become below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement.

[0012] moreover, the refrigerant circuit equipment concerning this invention -- the above -- pass the exchange approach of which refrigerant circuit -- it is constituted.

[0013] Moreover, the refrigerant circuit which comes to connect a compressor, the first condenser, the second condenser, a diaphragm means, and an evaporator for sequential piping, The closing motion means to which the closedown of the circulation of the refrigerant to said second condenser is carried out, and a temperature detection means to detect the condensation temperature of a pressure detection means to detect the condensation pressure of said first condenser, or said first condenser, It has the control means which carries

out closing motion control of said closing motion means according to the temperature detected with the pressure detected with said pressure detection means, or said temperature detection means.
[0014] Moreover, let the second condenser be a water cooling type condenser.
[0015] Moreover, let the second condenser be a cold energy heat storage tank.
[0016] Moreover, the second condenser has the evaporator of other refrigerant circuits, and makes heat exchange possible mutually.
[0017] Moreover, it has the refrigerant circuit which comes to connect the evaporator arranged at a compressor, a condenser, a diaphragm means, and two or more juxtaposition for sequential piping, a pressure detection means to detect the condensation pressure of said condenser, and the control means to which two or more of said part or all evaporative power force of an evaporator are reduced when the pressure detected with said pressure detection means exceeds a predetermined value.
[0018] Moreover, the refrigerants to be used are refrigerants other than R22 or R407C, and the saturation pressure in the same temperature considers as the refrigerant which has pressure characteristics higher than any of R22 or R407C.
[0019] Moreover, when using the refrigerant circuit which comes to connect two or more compressors and condensers, a diaphragm means, and an evaporator for sequential piping, and the refrigerant in which the refrigerant to be used is except R22 and R407C, and the saturation pressure to the temperature of arbitration has a saturation pressure property higher than either a refrigerant R22 or refrigerant R407C, it has said control means which made possible two or more operation controls of the compressor of a base according to the individual.
[0020]
[Embodiment of the Invention] The gestalt of implementation of this invention is explained about drawing below gestalt 1. of operation. Drawing 1 shows the refrigerant circuit Fig. of the air conditioner in the gestalt 1 of implementation of this invention. In drawing, 1 is a pressure sensor with which a compressor and 16 detect a solenoid valve for a flow control valve, and 4a and 4b to stop 27, and for the heat-souce side auxiliary heat exchanger of a water cooling type, and 3a and 3b stop [a four way valve and 2a] heat-souce side auxiliary heat exchanger 2b in an air-cooled heat-souce side main heat exchanger and 2b, as for a use side heat exchanger and 28, and 20 detects the pressure of the high-tension side of a compressor. It connects for refrigerant piping and these constitute the refrigerant circuit. The part between part [between a four way valve 16 - use side heat exchanger 4a, and 4b], flow-control-valvesa [3] and 3b - heat-souce side main- among refrigerant piping heat exchanger 2a or heat-souce side auxiliary heat exchanger 2b is laid under the wall of a building, or is arranged in the underpart of the roof.
[0021] Heat-souce side auxiliary heat exchanger 2b serves as a water cooling type which can carry out heat exchange of a refrigerant and the cooling water, and the water which is a cooling fluid is always supplied from the outside, and is. Moreover, R410A which is the mixed refrigerant of a HFC system is used for the refrigerant currently used for this refrigerant circuit. Since R410A has the high saturation pressure to the same temperature compared with R22 refrigerant mainly used with the air-conditioning machine from the former, the working pressure in a condenser also rises. In addition, established piping which will remain in a building if it is made for working pressure not to exceed 3MPa(s) when using the air-conditioning machine corresponding to R410A in the building where will carry out an abnormal stop in if high pressure exceeds 3MPa(s) in the case of R22 which is the conventional refrigerant, and he is trying not to improve a pressure any more in, and the air-conditioning machine for [already for many years] R22 is used is reusable as it is. The practice arrow head in drawing shows the flow of the refrigerant at the time of air conditioning, and a broken-line arrow head shows the flow direction of the refrigerant at the time of heating.
[0022] Drawing 2 is the control-block Fig. of each part article of drawing 1 . The operation control section 19 receives the signal of operation of the use side heat exchangers 4a and 4b, and a halt with remote control 5a and 5b. Moreover, the input of a pressure sensor 20 is also received. And the operation control section 19 takes out closing motion of the start and stop of a compressor 1, a four way valve 16, and the flow rate valves 3a and 3b, and the closing motion output of solenoid valves 27 and 28. In addition, a four way valve 16 flows air conditioning (the direction circuit of a continuous-line arrow head) in off, and serves as heating flow by on, and solenoid valves 27 and 28 are close solenoid valves in open and off at on.
[0023] The refrigerant circuit constituted as mentioned above samples a refrigerant from the established refrigerant circuit which used R22 refrigerant, and separates from a compressor to a heat-source side heat exchanger from piping after that, and each component to heat-source side main heat exchanger 2a with which the R410A refrigerant was instead enclosed from the compressor 1 and heat-source side auxiliary heat exchanger 2b, and a solenoid valve 28 is connected. Moreover, if needed, a use side heat exchanger and a flow rate valve are separated from piping, and, instead, the flow rate valves 3a and 3b are connected to new use

side heat exchanger 4a and 4b list. The part between part [between the four way valve 16 which is laid under the wall of a building among estab[illegible] refrigerant piping by exchange of su[illegible] refrigerant circuit, or is arranged in the underpart of the roof - use side heat exchanger 4a, and 4b], flow-control-valvesa [3] and 3b - heat-souce side main heat exchanger 2a, or heat-souce side auxiliary heat exchanger 2b is used as it is.

[0024] Moreover, unitization of compressor 1 four-way-valve 16 - heat-souce side main heat exchanger 2a or heat-souce side auxiliary heat exchanger 2b - the solenoid valve 28 is carried out as heat-source side units, such as an outdoor unit, they are equipped in this unit, and it is exchanged for coincidence also about the operation control section which controls closing motion of the operation frequency of a compressor, or various valves, and opening. In exchange order, a thing with the capacity which can be operated so that the working pressure (saturation pressure) in the refrigerant circuit after exchange may not exceed the working pressure (saturation pressure) of the refrigerant circuit before exchange is chosen, and a heat-souce side heat exchanger, a use side heat exchanger, and an operation control section are installed.

[0025] Drawing 3 is a control flow chart by the operation control section 19 of the air conditioner of this invention. Suppose that remote control actuation entered at step 0 first. on/off of remote control 5a is checked at step s1. If remote control 5a is on, flow rate valve 3a will be opened at step s2, and it will be made for a refrigerant to flow. If remote control 5a is not on, flow rate valve 3a will make closed actuation perform at step s3.

[0026] Next, on/off of remote control 5b is checked at step s4. When remote control 5b is not on, it checks whether remote control 5a has been on at step s7, and although checked like remote control 5a also here, if remote control 5a is not on, since all remote control will call it off in practice by a failure etc., operation will not be carried out and will be considered as a halt at step s8. If it is checked by step 6 that one of remote control is on, the mode in which remote control was inputted at step s6 will judge in air conditioning or heating. Although it will progress to step s10 if it is in heating mode, it omits about actuation after it.

[0027] In the case of air conditioning mode, it progresses to step s11 and a four way valve 16 is set to OFF, and each turns OFF solenoid valves 27 and 28 at step s12, and it is made for a refrigerant not to flow to heat-souce side auxiliary heat exchanger 2b in the beginning. Next, a compressor 1 is made to operate at step s13. A pressure is made to detect by the pressure sensor 20 at step s14 after that. The detection location of a pressure sensor 20 is not greatly separated from heat-souce side heat exchanger 2a and 2b, but since the differences of a piping pressure loss are also few and are not spread, it can be treated as equivalent to a condensation pressure.

[0028] At step s15, the condition of solenoid valves 27 and 28 is once checked. This is because the criteria accompanying closing motion of solenoid valves 27 and 28 are distinguished at steps s16 and s17. When solenoid valves 27 and 28 are judged at step s15 to be off, it progresses to step s17, and it judges whether the detected pressure force (HPS) of a pressure sensor 20 is over 2.7MPa(s). In the case of R22 which is a refrigerant conventionally here, 3MPa(s) are made into the upper limit, but when a pressure goes abruptly up transitionally, it has, and the judgment pressure is made into 2.7MPa(s) and lowness.

[0029] When it is over 2.7MPa(s) here, solenoid valves 27 and 28 are turned ON at step s19 for high-pressure control. By turning ON solenoid valves 27 and 28, heat exchange starts between cooling water because a refrigerant flows to auxiliary heat exchanger 2b. In R410A, when it comes to condensation pressure 2.7MPa, condensation temperature is around 45 degrees C. Although air temperature changes in a season and a location, when what cannot be easily influenced of the temperature of air, such as an underground water, is used for cooling water, or when that it is lower than air temperature enough supplies from the source guaranteed, the condensation temperature of a refrigerant will fall rather than heat-souce side heat exchanger 2a by the air heat source. Therefore, a pressure declines, without approaching 3MPa(s) whose condensation pressures are upper limits.

[0030] Once solenoid valves 27 and 28 open, pressure detection of s14 is repeated, and when it falls to less than 2.5 MPas at step s16, solenoid valves 27 and 28 are again set to OFF (step s18). The pressure decision value is changed at steps s16 and s17 for it being expected that closing motion of solenoid valves 27 and 28 is repeated, and preventing it by change of a pressure, when it is made the same decision value. In a refrigerant like R410A with especially high working pressure, in a pyrosphere, since the pressure range of fluctuation by the same temperature gradient becomes narrow, and pressure variation becomes large even if it is a small temperature change, it is required for such a decision value to prepare differential pressure.

[0031] Thus, according to a condensation pressure, heat-souce side auxiliary heat exchanger 2b is used, and by controlling a condensation pressure buildup, the thick increment for securing the pressure resistance of a refrigerant pipe fitting and ingredient modification are unnecessary, and it becomes possible to suppress a cost rise of a product. Furthermore, an alternative refrigerant is also enabled to divert established piping of the complicated configuration in the building which was being conventionally used with the refrigerant, and

reduction of piping cost and construction costs and the energy loss accompanying abandonment can be controlled further, and it becomes possible to contribute also to environment preservation.

[0032] Moreover, even if it attaches a thermo sensor in heat-souce side heat exchanger 2a or refrigerant piping of that near instead of a pressure sensor 20, it detects ********** (not shown) and it carries out on/off control of solenoid valves 27 and 28 with the predetermined value (for example, if it is an equivalent for 2.7MPa(s) of an R410A refrigerant and is an equivalent for 43 degrees C and 2.5MPa 41 degrees C) of this condensation temperature so that a condensation pressure may be presumed from temperature, the same operation effectiveness is acquired.

[0033] Gestalt 2. drawing 4 of operation shows the refrigerant circuit Fig. of the air conditioner in the gestalt 2 of implementation of this invention. In drawing 4 , 1 is the heat-source side auxiliary heat exchanger in which a compressor and 2a have an air-cooled heat-souce side main heat exchanger, and 2b has a ice thermal storage tub, has a heat exhanger tube 7 inside, and makes heat exchange possible between ice or iced water, and a refrigerant. 3a and 3b a use side heat exchanger and 16 for a flow control valve, and 4a and 4b A four way valve, The solenoid valve which 11 has on piping taken out from between a four way valve and heat-souce side main heat exchanger 2a, The solenoid valve which 12 has on piping which connects flow control valves 3a and 3b to heat-souce side main heat exchanger 2a, and 13 are the solenoid valves formed on piping connected in the middle of piping which connects a solenoid valve 12 and flow control valves 3a and 3b from a heat exhanger tube 7 in heat-source side auxiliary heat exchanger 2b.

[0034] The solenoid valve formed on piping which connects the piping middle whose 14 connects the end of a heat exhanger tube 7, the use side heat exchangers 4a and 4b, and a four way valve 16, and 15 in the middle of piping which connects flow control valves 3a and 3b from heat-souce side main heat exchanger 2a The flow control valve prepared in heat-source side auxiliary heat exchanger 2b from this side of a solenoid valve 12 in the middle of piping which results in a heat exhanger tube 7, 27, the solenoid valve with which 28 was prepared in the entrance of heat-souce side main heat exchanger 2a, the pressure sensor with which 20 detects the discharge pressure of a compressor 1, and 21 are temperature sensors which detect the ice inside heat-source side auxiliary heat exchanger 2b, or the temperature of water. Each of solenoid valves 11-14, and 27 and 28 is close in open and off at on.

[0035] Drawing 5 is the control-block Fig. of the air conditioner by this invention. In drawing, 19 is an operation controller, and while judging shutdown in response to the input from the ** remote control 5a and 5b, the change in the mode any shall be carried out between air conditioning and heating by the use side heat exchangers 4a and 4b is determined. Furthermore in response to the input of a pressure sensor 20 and a coolant temperature sensor 21, and the information on a timer 22, control of a compressor 1, a four way valve 16, flow control valves 3a, 3b, and 15, and solenoid valves 11, 12, 13, 14, 25, and 26 is carried out.

[0036] In addition, compared with R22, R410A whose saturation pressure in the same temperature is a high refrigerant is enclosed with this refrigerant circuit. The refrigerant circuit constituted as mentioned above samples a refrigerant from the established refrigerant circuit which used R22 refrigerant, and separates from a compressor to a heat-source side heat exchanger from piping after that, and each component to heat-source side auxiliary heat exchanger 2b - a solenoid valve 13, and a solenoid valve 14 is connected to heat-source side main heat exchanger 2a with which the R410A refrigerant was instead enclosed from the compressor 1 - solenoid-valve 12 list.

[0037] Moreover, if needed, a use side heat exchanger and a flow rate valve are separated from piping, and, instead, the flow rate valves 3a and 3b are connected to new use side heat exchanger 4a and 4b list. The part between the part between the four way valve 16 which is laid under the wall of a building among established refrigerant piping by exchange of such a refrigerant circuit, or is arranged in the underpart of the roof - use side heat exchanger 4a, and 4b, flow control valves 3a and 3b - a solenoid valve 12, and 13 is used as it is.

[0038] Moreover, unitization of compressor 1 four-way-valve 16 - heat-souce side main heat exchanger 2a - a solenoid valve 12, and heat-souce side auxiliary heat exchanger 2b - solenoid valves 13 and 14 is carried out as heat-source side units, such as an outdoor unit, they are equipped in this unit, and it is exchanged for coincidence also about the operation control section which controls closing motion of the operation frequency of a compressor, or various valves, and opening. In exchange order, a thing with the capacity which can be operated so that the working pressure (saturation pressure) in the refrigerant circuit after exchange may not exceed the working pressure (saturation pressure) of the refrigerant circuit before exchange is chosen, and a heat-souce side heat exchanger, a use side heat exchanger, and an operation control section are installed.

[0039] Here, the actuation which generates ice in the ice thermal storage tub of heat-source side auxiliary heat exchanger 2b is explained based on the refrigerant circuit Fig. of drawing 4 . Icy generation actuation is usually performed at Nighttime (midnight power). The operation control section's 19 check of that this became time of day 22:00 by the timer 21 starts actuation. First, it is not based on the condition of operation of remote

control 5a and 5b and a halt, but it sets [set / to OFF / a close by-pass bulb completely and a solenoid valve 12] a four way valve 16 to OFF fo[illegible]w control valves 3a and 3b by consid[illegible] as a halt, and a compressor 1 makes it the direction of an air conditioning cycle. off, and 14, 25 and 26 set solenoid valves 11 and 13 to ON at coincidence. And a flow control valve 15 is also opened. That is, the refrigerant which came out of the compressor 1 passes along a flow control valve 15 through heat-souce side main heat exchanger 2a from a four way valve 16, and the circuit which flows to a compressor 1 again through a solenoid valve 14 and a four way valve 16 through a heat exhanger tube 7 is formed.

[0040] And a compressor 1 is started, and the gas refrigerant of elevated-temperature high pressure condenses the operation control section 19 in heat-souce side main heat exchanger 2a, and the thing used as liquid is decompressed by the flow control valve 15, and it serves as a low-temperature two phase refrigerant, and results in a heat exhanger tube 7. Water is contained in the interior of a ice thermal storage tub, the phase change of the heat exhanger tube 7 is carried out from water to ice in the place where temperature fell in a fall and below the freezing point with the flowing low-temperature refrigerant, and ice is generated. The refrigerant which came out of the heat exhanger tube 7 turns into a low-pressure gas refrigerant, and returns to a compressor 1 again through a solenoid valve 14 and a four way valve 16. In this way, although ice is generated in a ice thermal storage tub, in the phase in which 6 hours have passed after the water temperature detected with a coolant temperature sensor 21 when 8 hours have passed since generation initiation of the ice by the time check of a timer 22 arrived at the freezing point, it is judged as that by which ice was fully generated, and ice generation operation is ended.

[0041] In addition, in order to reduce the condensation pressure of an ice generate time, as shown in drawing 6 at the time of ice generation operation, auxiliary heat exchanger 2c may be prepared and the means to which the condensation capacity of a refrigerant is made to increase may be added by turning ON the solenoid valves 27 and 28 of order, and opening them. Although air cooling is sufficient as auxiliary heat exchanger 2c, since an underground water with temperature lower than air etc. can be used by considering as a water cooling type heat exchanger and heat-source temperature falls, to the fall of a condensation pressure, effectiveness is large.

[0042] Next, the control flow chart by the operation control section 19 of the refrigerant circuit of drawing 4 and drawing 7 explains the condensation pressure suppression under air conditioning operation. First, step s20 to s30 is the same as that of s10 from step s0 of drawing 3 in the gestalt 1 of operation of this invention, and omits explanation. If the operation control section 19 judges it as air conditioning at step s29, a four way valve 16 will be set to OFF at step s31. And solenoid valves 12, 25, and 26 are set to ON at step s32, and solenoid valves 11, 13, and 14 are set to OFF at step s33. Thereby, heat-souce side main heat exchanger 2a is made to act as a condenser, and a refrigerant ceases to flow to a ice thermal storage tub by making a flow control valve 15 close at step s34. And a compressor 1 is started at step 35.

[0043] After compressor 1 starting always detects the high pressure of a compressor 1 with a pressure sensor 20 at step s36. Since it is almost equal to a condensation pressure, the high pressure of a compressor 1 is used for condensation pressure control. The condensation pressure control is as follows. It judges [whether heat-souce side auxiliary heat exchanger 2b is already used at step s37, and] by the switching condition of solenoid valves 11 and 13. If solenoid valves 11 and 13 open, heat exchange can be carried out to the ice in the ice thermal storage tub of heat-souce side auxiliary heat exchanger 2b because the high-pressure refrigerant which passed through the four way valve 16 flows to a heat exhanger tube 7. At step s39, it judges whether the pressure HPS which the pressure sensor 20 detected is over 2.7MPa(s).

[0044] When it is over 2.7MPa(s), solenoid valves 11 and 13 are opened at step s40 in order to reduce a condensation pressure. By this, a ice thermal storage tub can act as a condenser, heat exchange can be carried out to the ice near [lower than air temperature] the freezing point, or iced water, and condensation temperature falls greatly. Once opening solenoid valves 11 and 13, it judges whether pressure detection is again performed at step s36, and a pressure HPS is set to less than 2.5 MPas at steps s37 and s38. When it is detected at step s38 that they are less than 2.5 MPas, it progresses to step s41, and the use side heat exchangers 4a and 4b aircondition in the refrigerating cycle which uses as a condenser only heat-souce side heat exchanger 2a which is air cooling again in turning off solenoid valves 11 and 13.

[0045] In addition, since closing motion of a solenoid valve generates frequently the reason for performing the pressure which uses ice thermal storage tub 2b as a condenser between 2.7MPa(s) and 2.5MPa(s) when the threshold of the pressure which opens and closes solenoid valves 11 and 13 is first set to one, preventing hunting is mentioned. When the frequency where a ice thermal storage tub is used is made [many] as other reasons and the utilization time is lengthened, consumption of the heat naturally stored as ice increases, it will dissolve and ice will carry out a water temperature rise for a short time. For this reason, the use frequency of a ice thermal storage tub is restricted to the flow and pressure requirement higher than 2.5MPa(s) so that

operation to which a pressure is fully reduced in an air conditioning time zone may be attained. When the ice thermal storage tub of sufficient magnitude is naturally obtained, it is making the condenser under air conditioning operation only into a ice thermal storage tub subject or a ice thermal storage tub (solenoid valves 25 and 26 are close at this time), and it is possible to carry out long duration operation of the low operation of a condensation pressure.

[0046] Thus, since the pressure resistance of a device be raise or there be no need for exchange of established piping by use the condensation operation choose by heat exchange with ice when a condensation pressure rise even when pressure suppression can fully be carry out and R410A with high working pressure be use as compared with R22 which be one of the refrigerants conventionally, it can consider as the product excellent in economical efficiency and energy saving nature.

[0047] Moreover, since the temperature is stable until it dissolves, in having the ingredient in which cold energy is stored in coagulation operations, such as ice, the engine performance stabilized also as a condensation operation can be expected, stable operation of an air conditioner is secured, and it becomes possible to consider as a reliable product. In addition, although heat-souce side heat exchanger 2a and heat-souce side auxiliary heat exchanger 2b were the relation of juxtaposition in drawing 5 , branching to a solenoid valve 11 is taken from the lower stream of a river of a solenoid valve 28, and the operation effectiveness same also as serial relation is acquired in the relation between heat-souce side heat exchanger 2a and heat-souce side auxiliary heat exchanger 2b as shown in drawing 8 .

[0048] Gestalt 3. drawing 9 of operation is the refrigerant circuit Fig. showing the air conditioner in the gestalt 3 of implementation of this invention. In drawing 9 , 1 is a pressure sensor with which a compressor and 16 detect a solenoid valve for a flow rate valve, and 4a and 4b to stop 27, and for a heat-souce side auxiliary heat exchanger, and 3a and 3b stop [a four way valve and 2a] heat-souce side auxiliary heat exchanger 2b in an air-cooled heat-souce side main heat exchanger and 2b, as for a use side heat exchanger and 28, and 20 detects the high pressure of a compressor. Furthermore, the refrigerant circuit is independently formed of a compressor 31, a condenser 32, a flow control valve 33, and heat-souce side auxiliary heat exchanger 2b.

[0049] Both the refrigerant circuits of the refrigerant circuit (it is henceforth called a main coolant circuit) which has a compressor 1, and the refrigerant circuit (it is henceforth called **********) which has a compressor 31 are sharing heat-souce side auxiliary heat exchanger 2b, and the heat exchange between each refrigerant circuit is possible for it here. In addition, R410A is enclosed also with ********** for R410A by the main coolant circuit. A four way valve 16 serves as a circuit by the side of air conditioning in off, and solenoid valves 27 and 28 are close in open and off at on. Drawing 10 is the control-block Fig. of the air conditioner by this invention, and the operation control section 19 manages the component part of a main coolant circuit, and the component part of **********.

[0050] The refrigerant circuit constituted as mentioned above samples a refrigerant from the established refrigerant circuit which used R22 refrigerant, and separates from a compressor to a heat-source side heat exchanger from piping after that, and each component to heat-source side main heat exchanger 2a with which the R410A refrigerant was instead enclosed from the compressor 1 and heat-source side auxiliary heat exchanger 2b, and a solenoid valve 28 is connected. Moreover, if needed, a use side heat exchanger and a flow rate valve are separated from piping, and, instead, the flow rate valves 3a and 3b are connected to new use side heat exchanger 4a and 4b list. The part between part [between the four way valve 16 which is laid under the wall of a building among established refrigerant piping by exchange of such a refrigerant circuit, or is arranged in the underpart of the roof - use side heat exchanger 4a, and 4b], flow-control-valvesa [3] and 3b - heat-souce side main heat exchanger 2a, or heat-souce side auxiliary heat exchanger 2b is used as it is.

[0051] Moreover, unitization of compressor 1 four-way-valve 16 - heat-souce side main heat exchanger 2a or heat-souce side auxiliary heat exchanger 2b - the solenoid valve 28 is carried out as heat-source side units, such as an outdoor unit, they are equipped in this unit, and it is exchanged for coincidence also about the operation control section which controls closing motion of the operation frequency of a compressor, or various valves, and opening. In exchange order, a thing with the capacity which can be operated so that the working pressure (saturation pressure) in the refrigerant circuit after exchange may not exceed the working pressure (saturation pressure) of the refrigerant circuit before exchange is chosen, and a heat-souce side heat exchanger, a use side heat exchanger, and an operation control section are installed.

[0052] Furthermore, ********** to which another unitization of arrangement or a compressor 31, a condenser 32, and the flow control valve 33 was carried out is also arranged by coincidence in the same unit as this outdoor unit with exchange of an outdoor unit.

[0053] Here explains actuation using the control flow chart by the operation control section 19 of drawing 11 . In drawing 11 , since step s42 to the step s52 is the same as step s0 to the step s10 of drawing 3 , explanation is omitted. When it is judged at step s51 that it is in air conditioning mode, a four way valve 16 is set to OFF at

step s53, and it is made for a refrigerant to flow only to heat-souce side main heat exchanger 2a as off also in solenoid valves 27 and 28 (step s[illegible]4). After starting a compressor 1 at s[illegible]55, a pressure sensor 20 detects high pressure, i.e., a condensation pressure, at step s56.

[0054] At step s57, it checks whether whether solenoid valves 27 and 28 are open is performing high-pressure fall control. When solenoid valves 27 and 28 are off, it checks whether the detection value of a pressure sensor is over 2.7MPa(s) at step s60. When having exceeded, it progresses to step s61, and high-pressure fall control is started. High-pressure fall control opens the flow control valve 33 of ********** at step s61 first, and then opens solenoid valves 27 and 28. And a compressor 31 is made to turn on at step s63. By this, by **********, the elevated temperature and the high-pressure gas refrigerant which came out of the compressor 31 condense with a condenser 32, and turn into high-pressure liquid cooling intermediation, and it is decompressed by wire drawing in a flow control valve 32, becomes low temperature and a low-pressure two phase refrigerant, and flows in heat-souce side auxiliary heat exchanger 2b.

[0055] The two phase refrigerant of low-temperature low voltage carries out endoergic from the elevated temperature of a main coolant circuit, and a high-pressure refrigerant inside heat-souce side auxiliary heat exchanger 2b, and self becomes a low-pressure gas refrigerant and returns to a compressor 32. Although heat is radiated with heat-souce side auxiliary heat exchanger 2b in a main coolant circuit, since the temperature of the refrigerant in heat-souce side auxiliary heat exchanger 2b by ********** is sufficiently lower than air temperature, the condensation effectiveness becomes large rather than air cooling, and the condensation pressure of a main coolant circuit declines. In addition, in drawing 11 , once solenoid valves 27 and 28 open, it progresses to step s59 from step s57, and it is used by condensation operation of heat-souce side auxiliary heat exchanger 2b by **********, continuing until the condensation pressure HPS detected by the pressure sensor 20 is less than 2.5MPa(s).

[0056] in addition, the compressor 31 of ********** -- capacity -- the flow of a displacement control shown in drawing 12 if it is made controllable -- the refrigeration capacity in heat-souce side auxiliary heat exchanger 2b is controllable to adjustable. If a compressor 31 is operated at step s67, at drawing 12 , compressor capacity will be changed at step s70 through step s68 by whether the condensation pressure HPS of a main coolant circuit is higher than 2.6MPa(s).

[0057] In being higher than 2.6MPa(s), the frequency of a compressor 31 is made to increase by 5% (step 71), and in being lower than 2.6MPa, it carries out the fall (step 72) of the compressor frequency 5% on the contrary. thus, when the condensation pressure in a main coolant circuit is higher than 2.6MPa(s) Make the evaporative power force in ********** increase, and the condensation capacity in a main coolant circuit is made to increase. When the condensation pressure in a main coolant circuit is lower than 2.6MPa(s) on the contrary By reducing the evaporative power force in ********** and reducing the condensation capacity in a main coolant circuit, a condensation pressure is lower than a predetermined value, and it becomes possible to make operation moreover stabilized carry out.

[0058] Thus, by preparing heat-souce side auxiliary heat exchanger 2b in a main coolant circuit, and realizing this cooling operation by **********, low-temperature cooling is attained and it becomes effective in the fall of a condensation pressure from air. And if the compressor 32 of ********** is adjustable, the fine stable control will be attained and dependability and the amenity will improve. And since established piping with which the refrigerants of low working pressure were equipped conventionally can be used while a main coolant circuit is realizable, and it is cheap and being able to make a main coolant circuit by the bill of materials of pressure resistance equivalent to R22 refrigerant, it is economical.

[0059] Gestalt 4. drawing 13 of operation is the refrigerant circuit Fig. showing the air conditioner in the gestalt 4 of implementation of this invention. It has the outside-air-temperature sensor 23 which detects the air temperature which flows to heat-souce side main heat exchanger 2a instead of the pressure sensor 20 in drawing 1 in the gestalt 1 of operation, and since it is the same as that of drawing 1 about the other configuration and the exchange approach of a refrigerant circuit, drawing 13 omits explanation. Drawing 14 is a control-block Fig. in this invention, and is equipped with the outside-air-temperature sensor 23 instead of the pressure sensor 20 in drawing 2 . In addition, the R410A refrigerant is used in this invention.

[0060] It becomes like [actuation / by this invention] the control flow chart by the operation control section 19 of drawing 15 , and since it is the same as that of control of drawing 3 which used the pressure sensor 20 about the actuation, only difference is explained here. In drawing 15 , OAT TA which the outside-air-temperature sensor 23 detected as a compressor 1 starting at step s85 at step 86 is detected. It checks whether the condition of solenoid valves 27 and 28 is seen at step s87, and condensation pressure drop actuation using heat-souce side auxiliary heat exchanger 2b is already carried out. Since heat-souce side auxiliary heat exchanger 2b is not used when solenoid valves 27 and 28 are OFF, the judgment with OAT TA is performed at step s89.

[0061] When the OAT is over 30 degrees C, it will be said that a condensation pressure may become close to 3MPa(s) exceeding 2.7MPa(s), sole[redacted] valves 27 and 28 are opened at step[redacted], and the fall of condensation temperature is promoted. Since the saturation pressure in the same about 30 degrees C as an OAT is extent which is less than 2MPa(s) a little, the temperature of the refrigerant in heat-souce side main heat exchanger 2a became higher than air temperature and this expects about 10-15 degrees C of temperature differentials of air temperature and refrigerant saturation temperature experientially from the R410A refrigerant property, it is because it becomes 40 degrees C - 45 degrees C, i.e., the pressure near 3MPa(s), by the coolant temperature. What is necessary is just to change the reference temperature to which open naturally and close solenoid valves 27 and 28 according to the pressure-temperature characteristic with a refrigerant with the working pressure higher than R22 in the same temperature also in other than an R410A refrigerant.

[0062] After opening solenoid valves 27 and 28 at step s91, it is the thing to which the OAT was detected at step s86, it shifted to step s88 from step s87, and OAT TA carried out 20 degrees C and which opens solenoid valves 27 and 28 until it turns. Thus, it becomes possible by determining whether use ********** 2b according to the temperature of the cooling fluid of heat-souce side main heat exchanger 2a using the outside-air-temperature sensor 23 to make a condensation pressure control with cheap equipment. Moreover, it becomes possible to use established piping which does not need to raise the reinforcement of refrigerant circuit components and has already been used as it is, even if it uses a refrigerant with high working pressure by control of a condensation pressure compared with R22 refrigerant currently used conventionally, and it becomes possible to offer the product excellent in economical efficiency.

[0063] Gestalt 5. drawing 16 of operation is the refrigerant circuit Fig. showing the air conditioner in the gestalt 5 of implementation of this invention. In drawing, 1 is a compressor and a pressure sensor with which in a four way valve and 2a a flow control valve, and 4a and 4b detect a use side heat exchanger, and, as for 20, a heat-souce side main heat exchanger, and 3a and 3b detect [16] the high-tension side of a compressor. Drawing 17 is the control-block Fig. of drawing 16 , and flow control valves 3a and 3b are controllable according to an individual. Moreover, R410A which is a mixed refrigerant is used for the refrigerant currently used for this refrigerant circuit. Since it is the same as that of the gestalt 1 of operation about the exchange approach of a refrigerant circuit, explanation is omitted. The practice arrow head in drawing shows the flow of the refrigerant at the time of air conditioning, and a broken-line arrow head shows the flow direction of the refrigerant at the time of heating.

[0064] Drawing 18 is the control flow chart of the operation control section 19 in the air conditioner of this invention. Actuation of this invention is explained according to drawing 18 . Control of this actuation is started from step s92 to which the power source was supplied first. A compressor 1 judges whether it is under [operation] ******** at step s93. If the compressor 1 is operating, it will progress to step s94 and will judge whether it is air conditioning operation.

[0065] In air conditioning operation, in step s95, the high-pressure pressure HPS which a pressure sensor 20 detects judges whether they are 2.5MPa(s). If it seems that HPS is over 2.5MPa(s), it will judge whether flow-control-valve 3a is open at step s96. That is, it judges whether use side heat exchanger 4a is acting as an evaporator. Then, if flow-control-valve 3a is open, the opening will be reduced 10% at step s98. Flow-control-valve 3a is not open, that is, when the refrigerant is not flowing to use side heat exchanger 4a, the opening of flow-control-valve 3b of another side is reduced 10% (step s97).

[0066] Thus, by reducing the opening of flow-control-valve 3a or 3b, a refrigerant flow rate falls and the evaporative power force declines. The amount of regurgitation refrigerants from a compressor 1 also falls as a result. That is, since the refrigerant flow rate condensed by heat-souce side main heat exchanger 2a also falls, the operation to which a condensation pressure, i.e., high pressure, falls is acquired.

[0067] In addition, a high-pressure fall can also be realized, whenever [need / for cooling capacity] being various according to the application of the room currently installed case [like the multi-mold air-conditioner of a large-sized building] as for the reason for reducing flow-control-valve 3a preferentially, and securing necessary minimum air-conditioning by not making a flow rate fall carry out but carrying out the flow rate fall of the room which is not so preferentially about the evaporator of the room in which cooling capacity is not reduced. About priority decision, a priority selecting switch (not shown) is formed and the approach of carrying out ranking is mentioned to the operation control section 19.

[0068] in addition, the use side heat exchangers 4a and 4b which judge that the urgency which lowers high pressure is high, connect and are operated in step s99 when HPS exceeds 2.7MPa(s) further -- in order to reduce any flow rate, coincidence is made to carry out the opening fall of the flow control valves 3a and 3b 10% (steps s100 and s101) In this way, the high-pressure reduction effectiveness is enlarged by enlarging the amount of flow rate falls.

[0069] Thus, since the rise of a condensation pressure can be controlled by necessary minimum cooling

capacity reduction in the air conditioner which has two or more use side heat exchangers by reducing the part or all the evaporative power force [redacted] use side heat exchanger according to [redacted] condensation pressure, Even when the alternative high refrigerant of working pressure is used compared with R22 grade which is a refrigerant conventionally Since it is not necessary to change established piping with a large scale which has a complicated path to a pressure-resistant high thing and it can be reused, without making components reinforcement high, it becomes possible to offer the air conditioner excellent in dependability, economical efficiency, and environment nature. In addition, although it is the case where the number of use side heat exchangers is two, in this example, in three or more sets of one set of the case, and the cases, the operation by the fall of the evaporative power force and effectiveness are acquired similarly.

[0070] Gestalt 6. drawing 19 of operation is the refrigerant circuit Fig. showing the air conditioner in the gestalt 6 of implementation of this invention. As for the compressor by which 1a and 1b were connected to juxtaposition, and 16, a heat-souce side main heat exchanger, and 3a and 3b of a four way valve and 2a are pressure sensors with which a flow control valve, and 4a and 4b detect a use side heat exchanger, and 20 detects the high-tension side of a compressor. Drawing 20 is the control-block Fig. of drawing 19 , and Compressors 1a and 1b are controllable according to an individual. Moreover, R410A which is a mixed refrigerant is used for the refrigerant currently used for this refrigerant circuit. Since it is the same as that of the gestalt 1 of operation about the exchange approach of a refrigerant circuit, explanation is omitted. The practice arrow head in drawing shows the flow of the refrigerant at the time of air conditioning, and a broken-line arrow head shows the flow direction of the refrigerant at the time of heating.

[0071] Drawing 21 is a control flow chart by the operation control section 19 of this invention. In drawing 21 , since step s102 to the step s112 is the same as step s10 from step 0 of drawing 3 , the explanation is omitted. If judged as air conditioning operation at step s112, while turning OFF a four way valve 16 at step s113 and making it an air conditioning cycle, compressor 1a and compressor 1b are started at steps s114 and s115. It judges whether pressure detection was performed at step s116 after starting a compressor, and the value is over 2.7MPa(s) at step s117. When it is over 2.7MPa(s), in order to make a pressure buildup control, compressor 1b is stopped (step s118). once stopping compressor 1b -- the steps s117 and s119 after pressure detecting at step s116 -- high pressure -- the reboot of compressor 1b is not carried out until HPS is less than 2.5MPa(s).

[0072] Thus, by stopping some compressors, when the same refrigerant circuit is constituted from two or more compressors in the air conditioner which used refrigerants, such as R410A with high working pressure, compared with refrigerants, such as R22, and high pressure rises It becomes possible to reduce a pressure immediately, without making capacity into zero also in the time of the condensation capacity fall by the rapid increment in a load, and the cooling fluid temperature rise in a condenser, since a refrigerant flow rate falls sharply. Since it can reuse without changing piping in an established building into a pressure-resistant high thing while it comes for R22 etc. to be possible to consider as a bill of materials with comparatively low pressure-proofing, it becomes it is reliable and possible to offer the product excellent in economical efficiency and environment nature.

[0073] Moreover, even if it attaches a thermo sensor in heat-souce side heat exchanger 2a or refrigerant piping of that near instead of a pressure sensor 20, it detects ********** (not shown) and it carries out on/off control of solenoid valves 27 and 28 with the predetermined value (for example, if it is an equivalent for 2.7MPa(s) of an R410A refrigerant and is an equivalent for 43 degrees C and 2.5MPa 41 degrees C) of this condensation temperature so that a condensation pressure may be presumed from temperature, the same operation effectiveness is acquired.

[0074] Although the gestalt of each above-mentioned implementation showed the example which used R410A as a refrigerant, a refrigerant is not restricted to this, and the same effectiveness will be acquired if it is the case where the refrigerant with which inflammable refrigerants, such as R32, are sufficient with a refrigerant, for example, working pressure becomes high rather than the refrigerant before exchanging after refrigerant exchange is used. Moreover, although the control judging pressure for carrying out high-pressure control is considered with the gestalt of the operation written the account of a top at 3 or less MPas of the high-pressure upper limit considered with R22 refrigerant, when the pressure resistance of established piping exceeds 3MPa(s), even if it raises a control judging pressure in the range which does not exceed pressure resistance, continuation use is possible for established piping, and the same operation effectiveness is presented.

[0075]

[Effect of the Invention] As mentioned above, according to this invention, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant. Since condensation capacity is

controlled so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement It becomes possible to use a refrigerant with high working pressure according to condensation capacity even in the refrigerant circuit where pressure resistance is low.

[0076] Moreover, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping transposes to a high pressure refrigerant, and since the evaporative-power force controls so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement, it becomes possible to use a refrigerant with high working pressure according to the evaporative-power force also in the refrigerant circuit where pressure resistance is low.

[0077] Moreover, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant. Since it exchanges for the condenser of capacity with which the saturation pressure in the refrigerant circuit by the refrigerant after replacement becomes below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement Even if the component of the refrigerant circuit where the pressure resistance before exchange is low is included, it becomes possible to use a refrigerant with high working pressure according to condensation capacity.

[0078] Moreover, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant. Since it exchanges for the evaporator in which a displacement control is possible so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement may become below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement Even if the component of the refrigerant circuit where the pressure resistance before exchange is low is included, it becomes possible to use a refrigerant with high working pressure according to the evaporative power force.

[0079] Moreover, the refrigerant which is a working fluid in the refrigerant circuit which comes to connect a compressor, a condenser, a diaphragm means, and an evaporator for sequential piping is transposed to a high pressure refrigerant. Since it exchanges for the control means which carries out pressure control so that the saturation pressure in the refrigerant circuit by the refrigerant after replacement may become below the proof-pressure pressure of components with the lowest pressure resistance among the component parts in the refrigerant circuit used before and after replacement Since saturation pressure can be controlled by pressure control even if the component of the refrigerant circuit where the pressure resistance before exchange is low is included, it becomes possible to use a refrigerant with high working pressure.

[0080] Moreover, with constituting refrigerant circuit equipment through the exchange approach of the refrigerant circuit a publication in one of the above, a product can be made cheap and the amount of the trash by exchange can also be reduced.

[0081] Moreover, the refrigerant circuit which comes to connect a compressor, the first condenser, the second condenser, a diaphragm means, and an evaporator for sequential piping, The closing motion means to which the closedown of the circulation of the refrigerant to said second condenser is carried out, and a temperature detection means to detect the condensation temperature of a pressure detection means to detect the condensation pressure of said first condenser, or said first condenser, Since it had the control means which carries out closing motion control of said closing motion means according to the temperature detected with the pressure detected with said pressure detection means, or said temperature detection means, it becomes possible to use a refrigerant with high working pressure according to condensation capacity even in the refrigerant circuit where pressure resistance is low.

[0082] Moreover, since the second condenser was used as the water cooling type condenser, a condensation pressure can be reduced sharply.

[0083] Moreover, since the second condenser was used as the cold energy heat storage tank, the source of heat dissipation of the stable low temperature can be secured, and dependability improves.

[0084] Moreover, since the second condenser has the evaporator of other refrigerant circuits and made heat exchange possible mutually, adjustment of condensation capacity is attained and the fine stable control corresponding to a load is attained.

[0085] Moreover, the refrigerant circuit which comes to connect the evaporator arranged at a compressor, a condenser, a diaphragm means, and two or more juxtaposition for sequential piping, Since it had a pressure

detection means to detect the condensation pressure of said condenser, and the control means to which two or more of said part or all evapora[redacted]power force of an evaporator are red[redacted] when the pressure detected with said pressure detection means exceeds a predetermined value The flow rate of a condenser can be reduced, a condensation pressure can be reduced, and the effectiveness which can control a pressure buildup is acquired, maintaining operation.

[0086] Moreover, even if the refrigerants to be used are refrigerants other than R22 or R407C and it is the refrigerant which has pressure characteristics with the saturation pressure higher than any of R22 currently used widely conventionally or R407C in the same temperature, it becomes possible to use it with the same pressure resistance as usual, and the refrigerant corresponding to the purposes, such as a global warming potential, can be used.

[0087] Moreover, the refrigerant circuit which comes to connect two or more compressors and condensers, a diaphragm means, and an evaporator for sequential piping, When the refrigerant in which the refrigerant to be used is except R22 and R407C, and the saturation pressure to the temperature of arbitration has a saturation pressure property higher than either a refrigerant R22 or refrigerant R407C is used, Since it had said control means which made possible two or more operation controls of the compressor of a base according to the individual, continuation of operation is attained without making the engine performance into zero, even when a pressure rises.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 1 of implementation of this invention.

[Drawing 2] It is a control-block Fig. concerning the gestalt 1 of implementation of this invention.

[Drawing 3] It is a control flow chart Fig. concerning the gestalt 1 of implementation of this invention.

[Drawing 4] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 2 of implementation of this invention.

[Drawing 5] It is a control-block Fig. concerning the gestalt 2 of implementation of this invention.

[Drawing 6] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 2 of implementation of this invention.

[Drawing 7] It is a control flow chart Fig. concerning the gestalt 2 of implementation of this invention.

[Drawing 8] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 2 of implementation of this invention.

[Drawing 9] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 3 of implementation of this invention.

[Drawing 10] It is a control-block Fig. concerning the gestalt 3 of implementation of this invention.

[Drawing 11] It is a control flow chart Fig. concerning the gestalt 3 of implementation of this invention.

[Drawing 12] It is a control flow chart Fig. concerning the gestalt 3 of implementation of this invention.

[Drawing 13] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 4 of implementation of this invention.

[Drawing 14] It is a control-block Fig. concerning the gestalt 4 of implementation of this invention.

[Drawing 15] It is a control flow chart Fig. concerning the gestalt 4 of implementation of this invention.

[Drawing 16] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 5 of implementation of this invention.

[Drawing 17] It is a control-block Fig. concerning the gestalt 5 of implementation of this invention.
[Drawing 18] It is a control flow chart Fig. concerning the gestalt 5 of implementation of this invention.
[Drawing 19] It is the refrigerant circuit Fig. showing the air conditioner in the gestalt 6 of implementation of this invention.
[Drawing 20] It is a control-block Fig. concerning the gestalt 6 of implementation of this invention.
[Drawing 21] It is a control flow chart Fig. concerning the gestalt 6 of implementation of this invention.
[Description of Notations]
1 Compressor 1a Compressor 1B Compressor 2a Heat-Souce Side Main Heat Exchanger, 2b Heat-souce side auxiliary heat exchanger 2c Auxiliary heat exchanger 3a Flow rate control unit, 3b Flow rate control unit 4a Use side heat exchanger 4b Use side heat exchanger, 5a Remote control 5b Remote control 7 Heat exhanger tube, 11-14 Solenoid valve 15 Flow rate control unit 16 Four way valve 19 Operation control section 20 Pressure sensor 21 Coolant temperature sensor 23 OAT sensor 24 to 28 solenoid valve.

[Translation done.]

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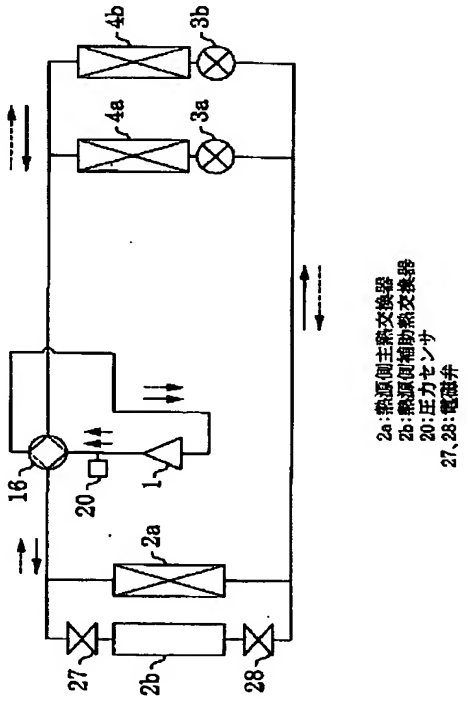
(54)【発明の名称】　冷媒回路の制御方法および交換方法並びに冷媒回路装置

(57)【要約】
【課題】　動作圧力が高い冷媒を使用した場合、冷媒回路部品の耐圧強度を上げる必要があり、また配管経路の複雑な大型建物では既設配管の入れ替えによるコスト増、廃棄物増加の問題が発生する。
【解決手段】　圧縮機１、熱源側主熱交換器２ａ、熱源側補助熱交換器２ｂ、流量制御装置３ａ、３ｂ、利用側熱交換器４ａ、４ｂを配管で接続してなる冷媒回路と、熱源側補助熱交換器２ｂへの冷媒の流通を閉止させる電磁弁２７、２８と、熱源側主熱交換器２ａの凝縮圧力を検知する圧力センサ２０と、圧力センサ２０により検知した圧力に応じて電磁弁２７、２８を開閉制御する運転制御部１９とを備えた。



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【特許請求の範囲】

【請求項１】　圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう凝縮能力を制御することを特徴とする冷媒回路の制御方法。

【請求項２】　圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう蒸発能力を制御することを特徴とする冷媒回路の制御方法。

【請求項３】　圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となる容量の凝縮器に交換することを特徴とする冷媒回路の交換方法。

【請求項４】　圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう容量制御可能な蒸発器に交換することを特徴とする冷媒回路の交換方法。

【請求項５】　圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう圧力制御する制御手段に交換することを特徴とする冷媒回路の交換方法。

【請求項６】　請求項３乃至５の何れか１項に記載の冷媒回路の交換方法を経て構成されたことを特徴とする冷媒回路装置。

【請求項７】　圧縮機、第一の凝縮器、第二の凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路と、前記第二の凝縮器への冷媒の流通を閉止させる開閉手段と、前記第一の凝縮器の凝縮圧力を検知する圧力検知手段もしくは前記第一の凝縮器の凝縮温度を検知する温度検知手段と、前記圧力検知手段により検知した圧力もしくは前記温度検知手段により検知した温度に応じて前記開閉手段を開閉制御する制御手段とを備えたことを特徴とする冷媒回路装置。

【請求項８】　第二の凝縮器を水冷式凝縮器としたことを特徴とする請求項７記載の冷媒回路装置。

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【請求項９】　第二の凝縮器を冷熱蓄熱槽としたことを特徴とする請求項７記載の冷媒回路装置。

【請求項１０】　第二の凝縮器が他の冷媒回路の蒸発器を有し、互いに熱交換可能なことを特徴とする請求項７記載の冷媒回路装置。

【請求項１１】　圧縮機、凝縮器、絞り手段および複数の並列に配置された蒸発器を順次配管で接続してなる冷媒回路と、前記凝縮器の凝縮圧力を検知する圧力検知手段と、前記圧力検知手段により検知した圧力が所定値を超えた場合には前記複数の蒸発器の一部もしくは全部の蒸発能力を低下させる制御手段とを備えたことを特徴とする冷媒回路装置。

【請求項１２】　使用する冷媒がＲ２２もしくはＲ４０７Ｃ以外の冷媒であり、かつ同一温度での飽和圧力が、Ｒ２２もしくはＲ４０７Ｃのいずれよりも高い圧力特性を有する冷媒であることを特徴とする請求項７乃至１１の何れかに記載の冷媒回路装置。

【請求項１３】　複数台の圧縮機、凝縮器、絞り手段および蒸発器を順次配管で接続してなる冷媒回路と、使用する冷媒がＲ２２、Ｒ４０７Ｃ以外であり、かつ任意の温度に対する飽和圧力が冷媒Ｒ２２もしくは冷媒Ｒ４０７Ｃのいずれか一方より高い飽和圧力特性を持つ冷媒を使用する場合、前記複数台の圧縮機を個別に運転制御可能とした制御手段とを備えたことを特徴とする冷媒回路装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、動作圧力の高い冷媒を用いる空気調和機や冷凍機等の冷媒回路装置に関するものである。

【０００２】

【従来の技術】事務所等では複数の部屋を個別に空調すべく、複数の室内機を同時もしくは個別に運転できるマルチタイプの空気調和機を備える場合が多く、熱源機から室内機につながる配管は配管長も長く、途中に曲げや分岐が必要となり、 配管形状も複雑となっている。従来の空気調和機では主としてＨＣＦＣ系のＲ２２冷媒を用いており、冷媒回路を構成する部品は使用冷媒の動作圧力に応じてその強度が確保される仕様となっていた。しかし、従来より使用していた冷媒の中には地球環境保全上好ましくないものが存在し、このため代替冷媒への切替が進められている。そして、比較的規模の大きい空調システムの場合にはＲ２２と圧力特性が似ているという理由から、代替冷媒としてＨＦＣ系のＲ４０７Ｃが使用される場合がある。

【０００３】

【発明が解決しようとする課題】冷凍サイクルとしての効率を上げ、エネルギー消費電力を低下させるには同一温度で密度の高い、つまり動作圧力の高い冷媒を使用することが考えられる。これは密度が高いことにより、同

一質量流量に対する体積流量の低下から、配管内流速が低下し圧力損失も低下することが期待されるからである。Ｒ４０７ｃは圧力特性がＲ２２と略同一であるため、その性能はＲ２２と類似したものである。そのため、Ｒ２２を使用する場合に比べて大きな省エネルギ性は期待できない。

【０００４】代替冷媒の中には、Ｒ２２やＲ４０７Ｃ冷媒に比べ、同じ温度における動作圧力（飽和圧力）が高くなるものがあるためこうした冷媒の利用が省エネルギにつながる一方で、 こうした動作圧力の上昇に対応して冷媒回路構成部品の耐圧強度を高める必要がでてくることから、空気調和機のコスト上昇につながる場合が発生する。

【０００５】また、Ｒ２２が使用されてからすでに長い年月が経過しており、従来より備え付けていた製品の老朽化にともない熱源機や室内機の交換を行う場合がある。こうした場合、従来冷媒に比べて動作圧力の高い代替冷媒対応の製品を用いようとすると、そのままでは熱源機、室内機だけではなく、途中配管も肉厚の厚い配管に変更する必要が発生する。最大能力の大きい空気調和機は比較的大きな建物に設置されるため、室内機が１台であっても配管長が長くなり、途中に曲げ部があるとその配管の入れ替えは難しい。また、一冷媒回路に複数の室内機を有するシステムでは配管途中で各室内機ごとの分岐部分を有するため、複雑な形状でかつ規模の大きい配管システムを入れ替えるには多大な費用が必要となる。こうした既設配管の交換は経済的影響だけでなく、大型建物から発生する既設配管の廃棄物の運搬、廃棄処理、再生のためのエネルギー消費が必要となり、地球環境保全に悪影響を及ぼす。

【０００６】この発明は上記のような課題を解決するためになされたもので、冷媒回路を構成する部品の耐圧強度が低くても動作圧力の大きな冷媒を用いることを可能にすることを目的とする。

【０００７】

【課題を解決するための手段】この発明に係る冷媒回路の制御方法は、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう凝縮能力を制御する。

【０００８】また、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう蒸発能力を制御する。

【０００９】また、この発明に係る冷媒回路の交換方法は、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となる容量の凝縮器に交換する。

【００１０】また、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう容量制御可能な蒸発器に交換する。

【００１１】また、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう圧力制御する制御手段に交換する。

【００１２】また、この発明に係る冷媒回路装置は、上記何れかの冷媒回路の交換方法を経て構成されたものである。

【００１３】また、圧縮機、第一の凝縮器、第二の凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路と、前記第二の凝縮器への冷媒の流通を閉止させる開閉手段と、前記第一の凝縮器の凝縮圧力を検知する圧力検知手段もしくは前記第一の凝縮器の凝縮温度を検知する温度検知手段と、前記圧力検知手段により検知した圧力もしくは前記温度検知手段により検知した温度に応じて前記開閉手段を開閉制御する制御手段とを備えたものである。

【００１４】また、第二の凝縮器を水冷式凝縮器としたものである。

【００１５】また、第二の凝縮器を冷熱蓄熱槽としたものである。

【００１６】また、第二の凝縮器が他の冷媒回路の蒸発器を有し、互いに熱交換可能としたものである。

【００１７】また、圧縮機、凝縮器、絞り手段および複数の並列に配置された蒸発器を順次配管で接続してなる冷媒回路と、前記凝縮器の凝縮圧力を検知する圧力検知手段と、前記圧力検知手段により検知した圧力が所定値を超えた場合には前記複数の蒸発器の一部もしくは全部の蒸発能力を低下させる制御手段とを備えたものである。

【００１８】また、使用する冷媒がＲ２２もしくはＲ４０７Ｃ以外の冷媒であり、かつ同一温度での飽和圧力が、Ｒ２２もしくはＲ４０７Ｃのいずれよりも高い圧力特性を有する冷媒としたものである。

【００１９】また、複数台の圧縮機、凝縮器、絞り手段および蒸発器を順次配管で接続してなる冷媒回路と、使

用する冷媒がＲ２２、Ｒ４０７Ｃ以外であり、かつ任意の温度に対する飽和圧力が冷媒Ｒ２２もしくは冷媒Ｒ４０７Ｃのいずれか一方より高い飽和圧力特性を持つ冷媒を使用する場合、前記複数台の圧縮機を個別に運転制御可能とした制御手段とを備えたものである。

【００２０】

【発明の実施の形態】実施の形態１．以下、この発明の実施の形態を図について説明する。図１はこの発明の実施の形態１における空気調和機の冷媒回路図を示す。図において、１は圧縮機、１６は四方弁、２ａは空冷式の熱源機側主熱交換器、２ｂは水冷式の熱源機側補助熱交換器、３ａ、３ｂは流量制御弁、４ａ、４ｂは利用側熱交換器、２７、２８は熱源機側補助熱交換器２ｂを閉止するための電磁弁、２０は圧縮機の高圧側の圧力を検知する圧力センサである。これらは冷媒配管で接続され、冷媒回路を構成している。冷媒配管のうち、四方弁１６～利用側熱交換器４ａ、４ｂ間の一部、流量制御弁３ａ、３ｂ～熱源機側主熱交換器２ａまたは熱源機側補助熱交換器２ｂ間の一部は建物の壁に埋設されたり、天井裏に配設されたりしている。

【００２１】熱源機側補助熱交換器２ｂは、冷媒と冷却水とが熱交換できる水冷式となっており、冷却流体である水は常時外部から供給されいている。また、この冷媒回路に使用されている冷媒は、ＨＦＣ系の混合冷媒であるＲ４１０Ａを用いている。Ｒ４１０Ａは従来から主に空調機で使用されているＲ２２冷媒に比べて同一温度に対する飽和圧力が高いため、凝縮器での動作圧力も上昇する。なお、従来の冷媒であるＲ２２の場合には、高圧が３ＭＰａを超えると異常停止させ、それ以上圧力が上がらないようにしており、既に古くからＲ２２用の空調機が使われている建物において、Ｒ４１０Ａ対応の空調機を使用する場合、動作圧力が３ＭＰａを超えないようにすれば建物内に残る既設配管をそのまま再利用することができる。図中の実践矢印は冷房時の冷媒の流れを、破線矢印は暖房時の冷媒の流れ方向を示す。

【００２２】図２は図１の各部品の制御ブロック図である。運転制御部１９は、リモコン５ａ、５ｂにより、利用側熱交換器４ａ、４ｂの運転、停止の信号を受ける。また圧力センサ２０の入力も受ける。そして、運転制御部１９は圧縮機１の発停、四方弁１６、流量弁３ａ、３ｂの開閉、電磁弁２７、２８の開閉出力を出す。なお、四方弁１６はｏｆｆで冷房（実線矢印方向回路）流れ、ｏｎで暖房流れとなり、電磁弁２７、２８はｏｎで開、ｏｆｆで閉の電磁弁である。

【００２３】上記のように構成された冷媒回路は、Ｒ２２冷媒を用いた既設の冷媒回路から冷媒を抜き取り、その後圧縮機から熱源側熱交換器までを配管から切り離し、代わって圧縮機１からＲ４１０Ａ冷媒が封入された熱源側主熱交換器２ａおよび熱源側補助熱交換器２ｂ、電磁弁２８までの各構成要素を接続する。また、必要に応じて利用側熱交換器および流量弁を配管から切り離し、代わって新たな利用側熱交換器４ａ、４ｂ並びに流量弁３ａ、３ｂを接続する。このような冷媒回路の交換によって既設の冷媒配管のうち、建物の壁に埋設されたり、天井裏に配設されたりしている四方弁１６～利用側熱交換器４ａ、４ｂ間の一部、流量制御弁３ａ、３ｂ～熱源機側主熱交換器２ａまたは熱源機側補助熱交換器２ｂ間の一部はそのまま使用される。

【００２４】また、圧縮機１～四方弁１６～熱源機側主熱交換器２ａまたは熱源機側補助熱交換器２ｂ～電磁弁２８までは例えば室外ユニット等の熱源側ユニットとしてユニット化されており、このユニット内に装備され、圧縮機の運転周波数や各種弁の開閉、開度を制御する運転制御部についても同時に交換される。交換の前後において、熱源機側熱交換器、利用側熱交換器、運転制御部は交換後の冷媒回路における動作圧力（飽和圧力）が、交換前の冷媒回路の動作圧力（飽和圧力）を超えないよう運転できる能力を有したものが選択、設置される。

【００２５】図３は、本発明の空気調和機の運転制御部１９による制御フローチャートである。まずステップ０でリモコン操作が入ったとする。ステップｓ１でリモコン５ａのｏｎ／ｏｆｆを確認する。リモコン５ａがｏｎであればステップｓ２にて流量弁３ａを開いて冷媒が流れるようにする。リモコン５ａがｏｎでなければステップｓ３で流量弁３ａは閉動作を行わせる。

【００２６】次にステップｓ４でリモコン５ｂのｏｎ／ｏｆｆを確認する。ここでもリモコン５ａと同様に確認するが、リモコン５ｂがｏｎでなかった場合、ステップｓ７でリモコン５ａがｏｎであったかどうかを確認し、リモコン５ａがｏｎでなければ、操作ミス等で実際はリモコンがすべてｏｆｆということになるので運転はさせず、ステップｓ８で停止とする。ステップ６までに、いずれかのリモコンがｏｎであることが確認されれば、ステップｓ６にてリモコンの入力されたモードが冷房か暖房か判断する。暖房モードであれば、ステップｓ１０に進むが、それ以降の動作については省略する。

【００２７】冷房モードの場合には、ステップｓ１１に進み、四方弁１６をｏｆｆとし、ステップｓ１２で電磁弁２７、２８はいずれもｏｆｆにして、はじめは熱源機側補助熱交換器２ｂには冷媒が流れないようにする。次にステップｓ１３で圧縮機１を運転させる。その後ステップｓ１４で圧力センサ２０によって圧力を検知させる。圧力センサ２０の検出位置は、熱源機側熱交換器２ａ、２ｂから大きく離れておらず、配管圧損の差も僅かでしかないため、凝縮圧力と同等として扱うことができる。

【００２８】ステップｓ１５では、一旦電磁弁２７、２８の状態を確認する。これは電磁弁２７、２８の開閉に伴う判定条件をステップｓ１６とｓ１７で区別しているためである。ステップｓ１５で電磁弁２７、２８がｏｆ

ｆと判定された場合にはステップｓ１７に進み、圧力センサ２０の検知圧力（ＨＰＳ）が２．７ＭＰａを超えていないかどうか判定する。ここで従来冷媒であるＲ２２の場合には３ＭＰａを上限としているが、過渡的に圧力が急上昇する場合に備え、判定圧力を２．７ＭＰａと低めにしている。

【００２９】ここで２．７ＭＰａを超えている場合には高圧抑制のためにステップｓ１９で電磁弁２７、２８をｏｎにする。電磁弁２７、２８をｏｎにすることにより、補助熱交換器２ｂに冷媒が流れることで、冷却水との間で熱交換が始まる。Ｒ４１０Ａの場合、凝縮圧力２．７ＭＰａとなると凝縮温度が４５℃前後である。空気温度は、季節、場所で変化するが、冷却水に地下水など空気の温度の影響を受けにくいものを利用した場合や、十分空気温度より低いことが保証される水源から供給した場合には空気熱源による熱源機側熱交換器２ａよりも冷媒の凝縮温度が低下することになる。よって凝縮圧力が上限である３ＭＰａに近づくことなく圧力が低下する。

【００３０】一旦電磁弁２７、２８が開いたあとは、ｓ１４の圧力検出を繰り返し、ステップｓ１６にて２．５ＭＰａ未満に低下した場合に再度電磁弁２７、２８をｏｆｆとする（ステップｓ１８）。ステップｓ１６とｓ１７で圧力判定値を変えているのは、同一判定値にした場合、圧力の変化によって電磁弁２７、２８の開閉が繰り返されることが予想され、それを防ぐためである。特に、動作圧力の高いＲ４１０Ａのような冷媒では、高温域において、同一温度差による圧力変動幅が狭くなり、小さい温度変化であっても圧力変化が大きくなることから、こうした判定値に圧力差を設けることが必要である。

【００３１】このように、凝縮圧力に応じて熱源機側補助熱交換器２ｂを利用し、凝縮圧力上昇を抑制することで、冷媒配管部品の耐圧強度を確保するための肉厚増加、材料変更の必要なく、製品のコスト上昇を抑えることが可能となる。さらに、従来冷媒で使用していた建物内の複雑な形状の既設配管を代替冷媒でも流用することが可能となり、配管コスト、工事費用の低減、さらには廃棄に伴うエネルギー損失を抑制することができ、環境保全にも貢献することが可能となる。

【００３２】また、凝縮圧力を温度から推定するよう、圧力センサー２０の代わりに熱源機側熱交換器２ａもしくはその近傍の冷媒配管に温度センサーを取り付けて凝縮温度をを検知し(図示せず)、この凝縮温度の所定値（たとえば、Ｒ４１０Ａ冷媒の２．７ＭＰａ相当であれば４３℃、２．５ＭＰａ相当であれば４１℃）にて電磁弁２７、２８のｏｎ／ｏｆｆ制御を実施しても同様の作用効果が得られる。

【００３３】実施の形態２．図４はこの発明の実施の形態２における空気調和機の冷媒回路図を示す。図４において、１は圧縮機、２ａは空冷式の熱源機側主熱交換器、２ｂは氷蓄熱槽を有する熱源側補助熱交換器で、内部に伝熱管７を有して氷もしくは氷水と冷媒との間で熱交換可能としている。３ａ、３ｂは流量制御弁、４ａ、４ｂは利用側熱交換器、１６は四方弁、１１は四方弁と熱源機側主熱交換器２ａとの間から取り出した配管上にある電磁弁、１２は熱源機側主熱交換器２ａと流量制御弁３ａ、３ｂを結ぶ配管上にある電磁弁、１３は熱源側補助熱交換器２ｂ内に伝熱管７から電磁弁１２と流量制御弁３ａ、３ｂを結ぶ配管途中結ぶ配管上に設けられた電磁弁である。

【００３４】１４は伝熱管７の一端と利用側熱交換器４ａ、４ｂと四方弁１６を結ぶ配管途中とを結ぶ配管上に設けられた電磁弁、１５は熱源機側主熱交換器２ａから流量制御弁３ａ、３ｂを結ぶ配管途中で、電磁弁１２の手前から熱源側補助熱交換器２ｂ内に伝熱管７に至る配管途中に設けられた流量制御弁、２７、２８は熱源機側主熱交換器２ａの出入口に設けられた電磁弁、２０は圧縮機１の吐出圧力を検知する圧力センサ、２１は熱源側補助熱交換器２ｂ内部の氷、もしくは水の温度を検知する温度センサである。電磁弁１１～１４、２７、２８はいずれもｏｎで開、ｏｆｆで閉である。

【００３５】図５は、本発明による空気調和機の制御ブロック図である。図において、１９は運転制御器であり、はリモコン５ａ、５ｂからの入力を受けて運転停止を判定するとともに利用側熱交換器４ａ、４ｂで冷房、暖房のいずれを実施するかというモードの切り替えの決定を行う。さらに圧力センサ２０、水温センサ２１の入力、そしてタイマ２２の情報を受けて圧縮機１、四方弁１６、流量制御弁３ａ、３ｂ、１５、電磁弁１１、１２、１３、１４、２５、２６の制御を実施する。

【００３６】なお、この冷媒回路には、R２２に比べ、同一温度での飽和圧力が高い冷媒であるＲ４１０Ａが封入されている。上記のように構成された冷媒回路は、Ｒ２２冷媒を用いた既設の冷媒回路から冷媒を抜き取り、その後圧縮機から熱源側熱交換器までを配管から切り離し、代わって圧縮機１からＲ４１０Ａ冷媒が封入された熱源側主熱交換器２ａ～電磁弁１２並びに熱源側補助熱交換器２ｂ～電磁弁１３および電磁弁１４までの各構成要素を接続する。

【００３７】また、必要に応じて利用側熱交換器および流量弁を配管から切り離し、代わって新たな利用側熱交換器４ａ、４ｂ並びに流量弁３ａ、３ｂを接続する。このような冷媒回路の交換によって既設の冷媒配管のうち、建物の壁に埋設されたり、天井裏に配設されたりしている四方弁１６～利用側熱交換器４ａ、４ｂ間の一部、流量制御弁３ａ、３ｂ～電磁弁１２、１３間の一部はそのまま使用される。

【００３８】また、圧縮機１～四方弁１６～熱源機側主熱交換器２ａ～電磁弁１２および熱源機側補助熱交換器

２ｂ～電磁弁１３、１４までは例えば室外ユニット等の熱源側ユニットとしてユニット化されており、このユニット内に装備され、圧縮機の運転周波数や各種弁の開閉、開度を制御する運転制御部についても同時に交換される。交換の前後において、熱源機側熱交換器、利用側熱交換器、運転制御部は交換後の冷媒回路における動作圧力（飽和圧力）が、交換前の冷媒回路の動作圧力（飽和圧力）を超えないよう運転できる能力を有したものが選択、設置される。

【００３９】ここで、熱源側補助熱交換器２ｂの氷蓄熱槽内に氷を生成する動作について図４の冷媒回路図を基に説明する。氷の生成動作は通常夜間（深夜電力）に行われている。これはタイマー２１によって時刻２２：００となったことを運転制御部１９が確認すると動作を開始する。まず、リモコン５ａ、５ｂの運転、停止の状態によらず、圧縮機１は停止とし、流量制御弁３ａ、３ｂを全閉、電磁弁１２をｏｆｆ、四方弁１６をｏｆｆとして冷房サイクル方向とする。同時に電磁弁１１、１３をｏｆｆ、１４、２５、２６はｏｎとする。そして流量制御弁１５も開く。つまり、圧縮機１を出た冷媒は、四方弁１６から熱源機側主熱交換器２ａを経て流量制御弁１５を通り、伝熱管７を経て電磁弁１４、四方弁１６を通って再度圧縮機１に流れる回路が形成される。

【００４０】そして運転制御部１９は圧縮機１を起動させ、高温高圧のガス冷媒が熱源機側主熱交換器２ａにて凝縮し、液となったものが流量制御弁１５で減圧され、低温の二相冷媒となり伝熱管７に至る。氷蓄熱槽内部には水が入っており、伝熱管７を流れる低温冷媒により温度が低下、氷点以下に下がったところで水から氷へと相変化し、氷が生成される。伝熱管７を出た冷媒は低圧のガス冷媒となり、電磁弁１４、四方弁１６を経て再度圧縮機１に戻る。こうして氷蓄熱槽内に氷が生成されるが、タイマー２２の計時による氷の生成開始から８時間が経過した場合か、もしくは水温センサ２１により検知する水温が氷点に達してから６時間が経過した段階で、十分に氷が生成されたものと判断して氷生成運転を終了する。

【００４１】なお、氷生成時の凝縮圧力を低下させるため、氷生成運転時には図６に示すように、補助熱交換器２ｃを設け、前後の電磁弁２７、２８をｏｎにして開くことにより冷媒の凝縮能力を増加させる手段を付加しても良い。補助熱交換器２ｃは空冷式でも良いが、水冷式熱交換器とすることで空気より温度の低い地下水などを利用することができ、熱源温度が低下するため凝縮圧力の低下には効果が大きい。

【００４２】次に、冷房運転中の凝縮圧力抑制について図４の冷媒回路と図７の運転制御部１９による制御フローチャートにより説明する。まずステップｓ２０からｓ３０までは、本発明の実施の形態１における図３のステップｓ０からｓ１０と同一であり、説明は省略する。ステップｓ２９で運転制御部１９が冷房と判断すると、ステップｓ３１にて四方弁１６をｏｆｆとする。そして、ステップｓ３２で電磁弁１２、２５、２６はonとし、ステップｓ３３で電磁弁１１、１３、１４をｏｆｆとする。これにより、熱源機側主熱交換器２ａを凝縮器として作用させ、ステップｓ３４で流量制御弁１５を閉にすることで氷蓄熱槽へは冷媒が流れないようになる。そしてステップ３５で圧縮機１を起動させる。

【００４３】圧縮機１起動後は、ステップｓ３６で常に圧力センサ２０により圧縮機１の高圧を検知する。圧縮機１の高圧は、ほぼ凝縮圧力に等しいため、凝縮圧力制御用に用いている。凝縮圧力制御は以下の通りである。ステップｓ３７にて既に熱源機側補助熱交換器２ｂが使われているかどうか、電磁弁１１、１３の開閉状態で判断する。電磁弁１１、１３が開くと、四方弁１６を経た高圧冷媒が伝熱管７へ流れることで、熱源機側補助熱交換器２ｂの氷蓄熱槽内の氷と熱交換することができる。ステップｓ３９では、圧力センサ２０の検知した圧力HPSが２．７MPaを超えていないかどうか判断する。

【００４４】２．７ＭＰａを超えている場合には、凝縮圧力を低下させるべく、ステップｓ４０にて電磁弁１１、１３を開く。これにより、氷蓄熱槽が凝縮器として作用し、空気温度より低い氷点付近の氷、もしくは氷水と熱交換することができ、凝縮温度が大きく低下する。一旦電磁弁１１、１３を開いたあとは、再びステップｓ３６にて圧力検出を行い、ステップｓ３７、ｓ３８で圧力HPSが２．５MPa未満になるかどうか判断する。ステップｓ３８で２．５MPａ未満であることが検出された場合にはステップｓ４１に進み、電磁弁１１、１３をｏｆｆすることで、再び空冷式である熱源機側熱交換器２ａのみを凝縮器とする冷凍サイクルにて利用側熱交換器４ａ、４ｂにて冷房を実施する。

【００４５】なお、氷蓄熱槽２ｂを凝縮器として使用する圧力を２．７MPａから２．５MPａの間で行う理由は、まず、電磁弁１１、１３を開閉する圧力の閾値を１つとした場合には、頻繁に電磁弁の開閉が発生するため、ハンチングを防止することが挙げられる。他の理由として、氷蓄熱槽を利用する頻度を多くして利用時間を長くした場合、当然氷として貯えた熱の消費が多くなり、短時間で氷が融解、水温上昇してしまう。このため、冷房時間帯で十分に圧力を低下させる運転が可能となるよう、氷蓄熱槽の利用頻度を２．５MPａより高い圧力条件に限っている。当然、十分な大きさの氷蓄熱槽が得られている場合には、冷房運転中の凝縮器を氷蓄熱槽主体もしくは氷蓄熱槽のみとすることで（このとき電磁弁２５、２６は閉）、凝縮圧力の低い運転を長時間実施することが可能である。

【００４６】このように、凝縮圧力が上昇した場合に氷との熱交換によって還られる凝縮作用を利用することにより、圧力抑制を十分に実施でき、従来冷媒の一つであ

るＲ２２に比較して動作圧力の高いＲ４１０Ａを使用した場合でも機器の耐圧強度を上げたり、既設配管の交換の必要がないことから、経済性、省エネルギー性に優れた製品とすることができる。

【００４７】また、氷等凝固作用で冷熱を蓄えられる材料を有する場合には融解するまでその温度が安定していることから、凝縮作用としても安定した性能が期待でき、空気調和機の安定運転が確保され、信頼性の高い製品とすることが可能となる。なお、図５では熱源機側熱交換器２ａと熱源機側補助熱交換器２ｂが並列の関係であったが、図８に示すとおり、電磁弁１１への分岐を電磁弁２８の下流からとり、熱源機側熱交換器２aと熱源機側補助熱交換器２ｂの関係を直列の関係としても同様の作用効果が得られる。

【００４８】実施の形態３．図９はこの発明の実施の形態３における空気調和機を示す冷媒回路図である。図９において、１は圧縮機、１６は四方弁、２ａは空冷式の熱源機側主熱交換器、２ｂは熱源機側補助熱交換器、３ａ、３ｂは流量弁、４ａ、４ｂは利用側熱交換器、２７、２８は熱源機側補助熱交換器２ｂを閉止するための電磁弁、２０は圧縮機の高圧を検知する圧力センサである。さらに、圧縮機３１、凝縮器３２、流量制御弁３３、熱源機側補助熱交換器２ｂによって別に冷媒回路が形成されている。

【００４９】ここで熱源機側補助熱交換器２ｂは、圧縮機１を有する冷媒回路（以後、主冷媒回路とよぶ）と、圧縮機３１を有する冷媒回路（以後従冷媒回路とよぶ）の両冷媒回路で共有しており、それぞれの冷媒回路間の熱交換が可能となっている。なお、主冷媒回路にはＲ４１０Ａが、従冷媒回路にもＲ４１０Ａが封入されている。四方弁１６はｏｆｆで冷房側の回路となり、電磁弁２７、２８はｏｎで開、ｏｆｆで閉である。図１０は、本発明による空気調和機の制御ブロック図であり、主冷媒回路の構成部品ならびに従冷媒回路の構成部品を運転制御部１９が司っている。

【００５０】上記のように構成された冷媒回路は、Ｒ２２冷媒を用いた既設の冷媒回路から冷媒を抜き取り、その後圧縮機から熱源側熱交換器までを配管から切り離し、代わって圧縮機１からＲ４１０Ａ冷媒が封入された熱源側主熱交換器２ａおよび熱源側補助熱交換器２ｂ、電磁弁２８までの各構成要素を接続する。また、必要に応じて利用側熱交換器および流量弁を配管から切り離し、代わって新たな利用側熱交換器４ａ、４ｂ並びに流量弁３ａ、３ｂを接続する。このような冷媒回路の交換によって既設の冷媒配管のうち、建物の壁に埋設されたり、天井裏に配設されたりしている四方弁１６～利用側熱交換器４ａ、４ｂ間の一部、流量制御弁３ａ、３ｂ～熱源機側主熱交換器２ａまたは熱源機側補助熱交換器２ｂ間の一部はそのまま使用される。

【００５１】また、圧縮機１～四方弁１６～熱源機側主熱交換器２ａまたは熱源機側補助熱交換器２ｂ～電磁弁２８までは例えば室外ユニット等の熱源側ユニットとしてユニット化されており、このユニット内に装備され、圧縮機の運転周波数や各種弁の開閉、開度を制御する運転制御部についても同時に交換される。交換の前後において、熱源機側熱交換器、利用側熱交換器、運転制御部は交換後の冷媒回路における動作圧力（飽和圧力）が、交換前の冷媒回路の動作圧力（飽和圧力）を超えないよう運転できる能力を有したものが選択、設置される。

【００５２】さらに、室外ユニットの交換に伴ってこの室外ユニットと同一ユニット内に配設または圧縮機３１、凝縮器３２、流量制御弁３３が別ユニット化された従冷媒回路も同時に配設される。

【００５３】ここで動作について図１１の運転制御部１９による制御フローチャートを用いて説明する。図１１において、ステップｓ４２からステップｓ５２までは図３のステップｓ０からステップｓ１０までと同一であるため、説明は省略する。ステップｓ５１で冷房モードであると判断した場合には、ステップｓ５３で四方弁１６をｏｆｆとし、電磁弁２７、２８もｏｆｆとして熱源機側主熱交換器２ａにのみ冷媒が流れるようにする（ステップｓ５３、５４）。ステップｓ５５で圧縮機１を起動させたあとはステップｓ５６で高圧つまり凝縮圧力を圧力センサ２０によって検出する。

【００５４】ステップｓ５７では、電磁弁２７、２８が開いているかどうかによって高圧低下制御を行っているかどうか確認する。電磁弁２７、２８がｏｆｆの場合には、ステップｓ６０で圧力センサの検出値が２．７ＭＰａを超えていないかどうか確認する。もし超えている場合にはステップｓ６１に進み、高圧低下制御を開始する。高圧低下制御は、まずステップｓ６１にて従冷媒回路の流量制御弁３３を開き、次に電磁弁２７、２８を開く。そして、ステップｓ６３で圧縮機３１をonさせる。これによって従冷媒回路では、圧縮機３１から出た高温、高圧のガス冷媒が、凝縮器３２で凝縮し、高圧液冷媒となり、それが流量制御弁３２での絞り作用で減圧され、低温、低圧の二相冷媒になり熱源機側補助熱交換器２ｂ内に流れる。

【００５５】低温低圧の二相冷媒は、熱源機側補助熱交換器２ｂの内部で、主冷媒回路の高温、高圧冷媒から吸熱し、自身は低圧のガス冷媒になって圧縮機３２に戻る。主冷媒回路では熱源機側補助熱交換器２bで放熱するが、従冷媒回路による熱源機側補助熱交換器２ｂ内の冷媒の温度は空気温度より十分低いために、空冷よりも凝縮効果が大きくなり、主冷媒回路の凝縮圧力は低下する。なお図１１において、一旦電磁弁２７、２８が開いた後は、ステップｓ５７からステップｓ５９に進み、圧力センサ２０により検知された凝縮圧力HPSが２．５ＭＰａを下回るまで従冷媒回路による熱源機側補助熱交換器２ｂの凝縮作用が継続して使われる。

【００５６】なお、従冷媒回路の圧縮機３１を容量制御可能にすれば、図１２に示す容量制御のフローよって、熱源機側補助熱交換器２ｂでの冷却能力を可変に制御することができる。図１２では、ステップｓ６７にて圧縮機３１を運転すると、ステップｓ６８を経てステップｓ７０で主冷媒回路の凝縮圧力HPSが２．６MPaより高いかどうかで圧縮機容量を変化させる。

【００５７】２．６MPaより高い場合には、圧縮機３１の周波数を５％増加させ（ステップ７１）、２．６MPaより低い場合には反対に圧縮機周波数を５％低下（ステップ７２）させる。このようにして、主冷媒回路での凝縮圧力が２．６MPaより高い場合には、従冷媒回路での蒸発能力を増加させて主冷媒回路での凝縮能力を増加させ、反対に主冷媒回路での凝縮圧力が２．６MPaより低い場合には、従冷媒回路での蒸発能力を低下させて主冷媒回路での凝縮能力を低下させることで、凝縮圧力が所定値より低く、しかも安定した運転を実施させることが可能となる。

【００５８】このように、主冷媒回路において熱源機側補助熱交換器２ｂを設け、この冷却作用を従冷媒回路で実現させることによって、空気より低温の冷却が可能となり、凝縮圧力の低下に有効となる。そして、従冷媒回路の圧縮機３２が可変であれば、きめの細かい安定した制御が可能となり、信頼性、快適性が向上する。そして、Ｒ２２冷媒と同等の耐圧強度の部品構成によって主冷媒回路が実現でき、主冷媒回路を安価で作れるとともに従来、低い動作圧力の冷媒用に備えられた既設配管を用いることができるため経済的である。

【００５９】実施の形態４．図１３はこの発明の実施の形態４における空気調和機を示す冷媒回路図である。図１３は実施の形態１における図１での圧力センサ２０の代わりに、熱源機側主熱交換器２ａに流れる空気温度を検出する外気温センサ２３が備えられており、それ以外の構成および冷媒回路の交換方法については図１と同一であるため、説明を省略する。図１４は本発明での制御ブロック図であり、図２での圧力センサ２０の代わりに外気温センサ２３を備えている。なお本発明においては、Ｒ４１０Ａ冷媒を用いている。

【００６０】本発明による動作については、図１５の運転制御部１９による制御フローチャートのようになり、その動作については圧力センサ２０を用いた図３の制御と同様であるので、ここでは相違点についてのみ説明する。図１５において、ステップｓ８５で圧縮機１が起動するとステップ８６で外気温センサ２３の検知した外気温度ＴＡを検知する。ステップｓ８７で電磁弁２７、２８の状態をみて既に熱源機側補助熱交換器２ｂを使った凝縮圧力低下動作を実施しているかどうか確認する。電磁弁２７、２８がＯＦＦの場合は、熱源機側補助熱交換器２ｂを使用していないので、ステップｓ８９にて外気温度ＴＡでの判定を行う。

【００６１】外気温度が３０℃を超えている場合には凝縮圧力が２．７ＭＰａを超えて３ＭＰａに近くなる可能性があるということになり、ステップｓ９１で電磁弁２７、２８を開き、凝縮温度の低下を促進させる。これは、Ｒ４１０Ａ冷媒特性から、外気温度と同じ３０℃程度での飽和圧力が２ＭＰａを若干下回る程度であり、熱源機側主熱交換器２ａ内の冷媒の温度は空気温度より高くなり、経験的に空気温度と冷媒飽和温度の差温を１０～１５℃程度見込んでいることから、冷媒温度で４０℃～４５℃つまり３ＭＰａに近い圧力となるためである。当然、Ｒ２２より同一温度での動作圧力が高い冷媒でＲ４１０Ａ冷媒以外の場合もその圧力－温度特性に応じて電磁弁２７、２８を開閉する基準温度を変更すればよい。

【００６２】ステップｓ９１で電磁弁２７、２８を開いたあとは、ステップｓ８６にて外気温度の検出を行い、ステップｓ８７からステップｓ８８に移行して、外気温度ＴＡが２０℃をした回るまで電磁弁２７、２８を開いておくものである。このように、外気温センサ２３を用いて、熱源機側主熱交換器２ａの冷却流体の温度に応じて、従熱交換器２ｂを使用するかどうかを決定することで、安価な装置により、凝縮圧力を抑制させることが可能となる。また、凝縮圧力の抑制により、従来使われていたＲ２２冷媒等に比べ、動作圧力の高い冷媒を使用しても、冷媒回路部品の強度を高める必要がなく、また既に使用されている既設配管をそのまま利用することが可能となり、経済性に優れた製品を提供することが可能となる。

【００６３】実施の形態５．図１６はこの発明の実施の形態５における空気調和機を示す冷媒回路図である。図において、１は圧縮機、１６は四方弁、２ａは熱源機側主熱交換器、３ａ、３ｂは流量制御弁、４ａ、４ｂは利用側熱交換器、２０は圧縮機の高圧側を検知する圧力センサである。図１７は図１６の制御ブロック図であり、流量制御弁３ａ、３ｂは個別に制御可能となっている。また、この冷媒回路に使用されている冷媒は、混合冷媒であるＲ４１０Ａを用いている。冷媒回路の交換方法については実施の形態１と同様であるため、説明を省略する。図中の実践矢印は冷房時の冷媒の流れを、破線矢印は暖房時の冷媒の流れ方向を示す。

【００６４】図１８は、本発明の空気調和機における運転制御部１９の制御フローチャートである。図１８に従い、本発明の動作を説明する。まず電源が投入されたステップｓ９２から本動作の制御を開始する。ステップｓ９３で圧縮機１が運転中かどうか判断する。もし圧縮機１が運転していればステップｓ９４に進み、冷房運転かどうか判断する。

【００６５】冷房運転の場合は、ステップｓ９５において、圧力センサ２０の検知する高圧圧力ＨＰＳが２．５ＭＰａかどうか判断する。もしＨＰＳが２．５ＭＰａを

超えているようであれば、ステップｓ９６にて流量制御弁３ａが開いているかどうか判断する。つまり、利用側熱交換器４ａが蒸発器として作用しているかどうかを判断している。そこで流量制御弁３ａが開いていれば、ステップｓ９８でその開度を１０％低下させる。流量制御弁３ａが開いていない、つまり、利用側熱交換器４ａに冷媒が流れていない場合には、他方の流量制御弁３ｂの開度を１０％低下させる（ステップｓ９７）。

【００６６】このように、流量制御弁３ａもしくは３ｂの開度を減じることにより、冷媒流量が低下して蒸発能力が低下する。結果的に圧縮機１からの吐出冷媒量も低下する。すなわち、熱源機側主熱交換器２ａで凝縮される冷媒流量も低下することから、凝縮圧力つまり高圧が低下する作用が得られる。

【００６７】なお、流量制御弁３ａを優先的に減じる理由は、大型ビルのマルチ型エアコンのような場合、据え付けられている部屋の用途に応じて冷房能力の必要度がまちまちであり、冷房能力を低下させられない部屋の蒸発器については、流量低下は実施させず、そうでない部屋を優先的に流量低下させることで、必要最低限の空調を確保しながら高圧の低下も実現させることができる。優先順位決定については、運転制御部１９に優先順位選択スイッチ（図示せず）を設けて、順位付けする方法が挙げられる。

【００６８】なお、ステップｓ９９において、さらにＨＰＳが２．７ＭＰａを超えた場合には、高圧を下げる緊急性が高いと判断し、接続され、運転している利用側熱交換器４ａ、４ｂいずれの流量も低減させるために流量制御弁３ａ、３ｂを同時に１０％開度低下させる（ステップｓ１００、ｓ１０１）。こうして、流量低下量を大きくすることで高圧低減効果を大きくする。

【００６９】このように、複数の利用側熱交換器を有する空気調和機において、凝縮圧力に応じて利用側熱交換器の一部もしくは全部の蒸発能力を低下させることにより、必要最小限の冷房能力低減で凝縮圧力の上昇を抑制できるため、従来冷媒であるＲ２２等に比べ、動作圧力の高い代替冷媒を使用した場合でも、部品強度を高くすることなく、また、規模の大きい、複雑な経路を有する既設の配管を耐圧性の高いものに入れ替える必要なく再利用できることから、信頼性、経済性、環境性に優れた空気調和機を提供することが可能となる。なお、本実施例では利用側熱交換器が２台の場合であるが、１台の場合、もしくは３台以上の場合においても、同様に蒸発能力の低下による作用、効果が得られる。

【００７０】実施の形態６．図１９はこの発明の実施の形態６における空気調和機を示す冷媒回路図である。１ａ、１ｂは並列に接続された圧縮機、１６は四方弁、２ａは熱源機側主熱交換器、３ａ、３ｂは流量制御弁、４ａ、４ｂは利用側熱交換器、２０は圧縮機の高圧側を検知する圧力センサである。図２０は図１９の制御ブロック図であり、圧縮機１ａ、１ｂは個別に制御可能となっている。また、この冷媒回路に使用されている冷媒は、混合冷媒であるＲ４１０Ａを用いている。冷媒回路の交換方法については実施の形態１と同様であるため、説明を省略する。図中の実践矢印は冷房時の冷媒の流れを、破線矢印は暖房時の冷媒の流れ方向を示す。

【００７１】図２１は本発明の運転制御部１９による制御フローチャートである。図２１において、ステップｓ１０２からステップｓ１１２までは図３のステップ０からステップｓ１０と同一であるのでその説明を省略する。ステップｓ１１２で冷房運転と判断されると、ステップｓ１１３で四方弁１６をｏｆｆにして冷房サイクルにするとともに、ステップｓ１１４、ｓ１１５にて圧縮機１ａ、圧縮機１ｂを起動させる。圧縮機を起動後、ステップｓ１１６で圧力検知を行い、ステップｓ１１７でその値が２．７ＭＰａを超えているかどうか判断する。２．７ＭＰａを超えている場合には、圧力上昇を抑制させるため、圧縮機１ｂを停止させる（ステップｓ１１８）。一旦圧縮機１ｂを停止させたあとは、ステップｓ１１６での圧力検知後、ステップｓ１１７、ｓ１１９で高圧ＨＰＳが２．５ＭＰａを下回るまで圧縮機１ｂの再起動はさせない。

【００７２】このように、Ｒ２２などの冷媒に比べ動作圧力の高いＲ４１０Ａ等の冷媒を使用した空気調和機において同一冷媒回路を複数の圧縮機で構成し、高圧が上昇した場合には圧縮機の一部を停止させることにより、大幅に冷媒流量が低下するため、急激な負荷増加や、凝縮器での冷却流体温度上昇による凝縮能力低下時でも能力を零にすることなく即座に圧力を低下させることが可能となり、Ｒ２２など、比較的耐圧の低い部品構成とすることが可能でなるとともに、既設建物内の配管を耐圧性の高いものに変更することなく再利用できることから、信頼性が高く、経済性、環境性に優れた製品を提供することが可能となる。

【００７３】また、凝縮圧力を温度から推定するよう、圧力センサー２０の代わりに熱源機側熱交換器２ａもしくはその近傍の冷媒配管に温度センサーを取り付けて凝縮温度をを検知し(図示せず)、この凝縮温度の所定値（たとえば、Ｒ４１０Ａ冷媒の２．７ＭＰａ相当であれば４３℃、２．５ＭＰａ相当であれば４１℃）にて電磁弁２７、２８のｏｎ／ｏｆｆ制御を実施しても同様の作用効果が得られる。

【００７４】上記各実施の形態では、冷媒としてＲ４１０Ａを使用した例を示したが、冷媒はこれに限るものではなく、例えばＲ３２などの可燃性冷媒でもよく、その他、冷媒交換後に交換前の冷媒よりも動作圧力が高くなる冷媒を用いる場合であれば同様の効果が得られる。また、上記書く実施の形態では、高圧抑制するための制御判定圧力をＲ２２冷媒で考えられる高圧上限の３ＭＰａ以下で考えているが、既設配管の耐圧強度が３ＭＰａを

超える場合には、耐圧強度を超えない範囲で制御判定圧力を上昇させても既設配管は継続利用が可能であり、同様の作用効果を呈する。

【００７５】

【発明の効果】以上のように、この発明によれば、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう凝縮能力を制御するので、耐圧強度が低い冷媒回路でも凝縮能力によって動作圧力の高い冷媒を使用することが可能になる。

【００７６】また、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう蒸発能力を制御するので、耐圧強度が低い冷媒回路でも蒸発能力によって動作圧力の高い冷媒を使用することが可能になる。

【００７７】また、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となる容量の凝縮器に交換するので、交換前の耐圧強度が低い冷媒回路の構成要素を含んでいても凝縮能力によって動作圧力の高い冷媒を使用することが可能になる。

【００７８】また、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう容量制御可能な蒸発器に交換するので、交換前の耐圧強度が低い冷媒回路の構成要素を含んでいても蒸発能力によって動作圧力の高い冷媒を使用することが可能になる。

【００７９】また、圧縮機、凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路中の作動流体である冷媒をより高圧な冷媒に置き換え、置き換え後の冷媒による冷媒回路中の飽和圧力が、置き換えの前後で使用される冷媒回路中の構成部品のうちもっとも耐圧強度の低い部品の耐圧圧力以下となるよう圧力制御する制御手段に交換するので、交換前の耐圧強度が低い冷媒回路の構成要素を含んでいても圧力制御によって飽和圧力を抑制できるから、動作圧力の高い冷媒を使用することが可能になる。

【００８０】また、上記何れかに記載の冷媒回路の交換方法を経て冷媒回路装置を構成することで、製品を安価にでき、交換による廃棄物の量も削減できる。

【００８１】また、圧縮機、第一の凝縮器、第二の凝縮器、絞り手段、蒸発器を順次配管で接続してなる冷媒回路と、前記第二の凝縮器への冷媒の流通を閉止させる開閉手段と、前記第一の凝縮器の凝縮圧力を検知する圧力検知手段もしくは前記第一の凝縮器の凝縮温度を検知する温度検知手段と、前記圧力検知手段により検知した圧力もしくは前記温度検知手段により検知した温度に応じて前記開閉手段を開閉制御する制御手段とを備えたので、耐圧強度が低い冷媒回路でも凝縮能力によって動作圧力の高い冷媒を使用することが可能になる。

【００８２】また、第二の凝縮器を水冷式凝縮器としたので、凝縮圧力を大幅に低下させることができる。

【００８３】また、第二の凝縮器を冷熱蓄熱槽としたので、安定した低温の放熱源が確保でき、信頼性が向上する。

【００８４】また、第二の凝縮器が他の冷媒回路の蒸発器を有し、互いに熱交換可能にしたので、凝縮能力の調整が可能となり、負荷に対応したきめ細かい安定した制御が可能になる。

【００８５】また、圧縮機、凝縮器、絞り手段および複数の並列に配置された蒸発器を順次配管で接続してなる冷媒回路と、前記凝縮器の凝縮圧力を検知する圧力検知手段と、前記圧力検知手段により検知した圧力が所定値を超えた場合には前記複数の蒸発器の一部もしくは全部の蒸発能力を低下させる制御手段とを備えたので、凝縮器の流量を低下させて凝縮圧力を低下させることができ、運転を維持しながら圧力上昇を抑制できる効果が得られる。

【００８６】また、使用する冷媒がＲ２２もしくはＲ４０７Ｃ以外の冷媒であり、かつ同一温度での飽和圧力が、従来広く使用されていたＲ２２もしくはＲ４０７Ｃのいずれよりも高い圧力特性を有する冷媒であっても、従来と同様な耐圧強度で使用することが可能になり、地球温暖化係数等目的に合致した冷媒を使用できるようになる。

【００８７】また、複数台の圧縮機、凝縮器、絞り手段および蒸発器を順次配管で接続してなる冷媒回路と、使用する冷媒がＲ２２、Ｒ４０７Ｃ以外であり、かつ任意の温度に対する飽和圧力が冷媒Ｒ２２もしくは冷媒Ｒ４０７Ｃのいずれか一方より高い飽和圧力特性を持つ冷媒を使用する場合、前記複数台の圧縮機を個別に運転制御可能とした制御手段とを備えたので、圧力が上昇した場合でも性能を零にすることなく運転継続が可能になる。

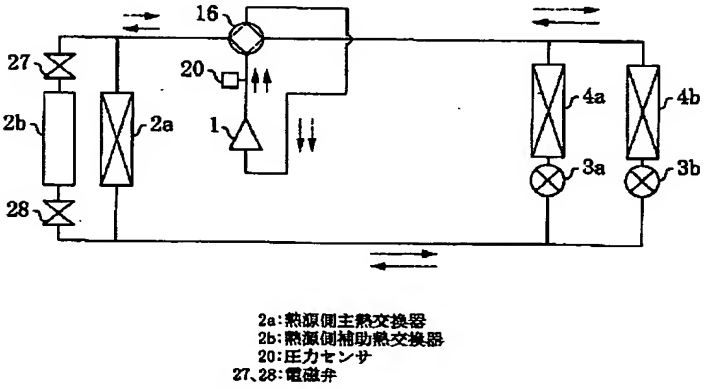
【図面の簡単な説明】

【図１】　この発明の実施の形態１における空気調和機を示す冷媒回路図である。

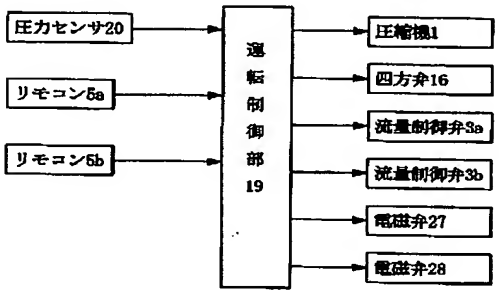
【図２】　この発明の実施の形態１に係る制御ブロック図である。

【図３】　この発明の実施の形態１に係る制御フローチャート図である。
【図４】　この発明の実施の形態２における空気調和機を示す冷媒回路図である。
【図５】　この発明の実施の形態２に係る制御ブロック図である。
【図６】　この発明の実施の形態２における空気調和機を示す冷媒回路図である。
【図７】　この発明の実施の形態２に係る制御フローチャート図である。
【図８】　この発明の実施の形態２における空気調和機を示す冷媒回路図である。
【図９】　この発明の実施の形態３における空気調和機を示す冷媒回路図である。
【図１０】　この発明の実施の形態３に係る制御ブロック図である。
【図１１】　この発明の実施の形態３に係る制御フローチャート図である。
【図１２】　この発明の実施の形態３に係る制御フローチャート図である。
【図１３】　この発明の実施の形態４における空気調和機を示す冷媒回路図である。
【図１４】　この発明の実施の形態４に係る制御ブロック図である。
＊【図１５】　この発明の実施の形態４に係る制御フローチャート図である。
【図１６】　この発明の実施の形態５における空気調和機を示す冷媒回路図である。
【図１７】　この発明の実施の形態５に係る制御ブロック図である。
【図１８】　この発明の実施の形態５に係る制御フローチャート図である。
【図１９】　この発明の実施の形態６における空気調和機を示す冷媒回路図である。
【図２０】　この発明の実施の形態６に係る制御ブロック図である。
【図２１】　この発明の実施の形態６に係る制御フローチャート図である。
【符号の説明】
１　圧縮機、　１ａ　圧縮機、　１ｂ　圧縮機、　２ａ　熱源機側主熱交換器、　２ｂ　熱源機側補助熱交換器、　２ｃ　補助熱交換器、　３ａ　流量制御装置、　３ｂ　流量制御装置、　４ａ　利用側熱交換器、　４ｂ　利用側熱交換器、　５ａ　リモコン、　５ｂ　リモコン、　７　伝熱管、　１１～１４　電磁弁、　１５　流量制御装置、　１６　四方弁、　１９　運転制御部、　２０　圧力センサー、　２１　水温センサー、　２３　外気温度センサー、　２４～２８電磁弁。

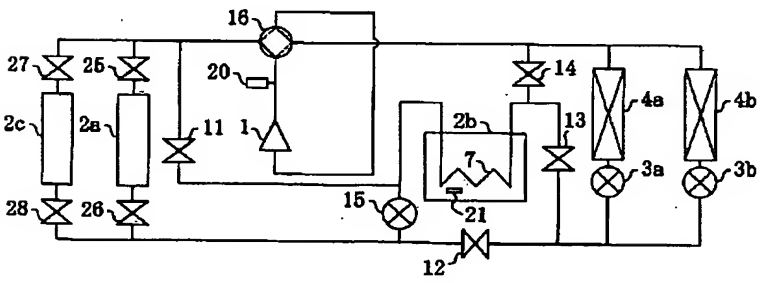
【図１】



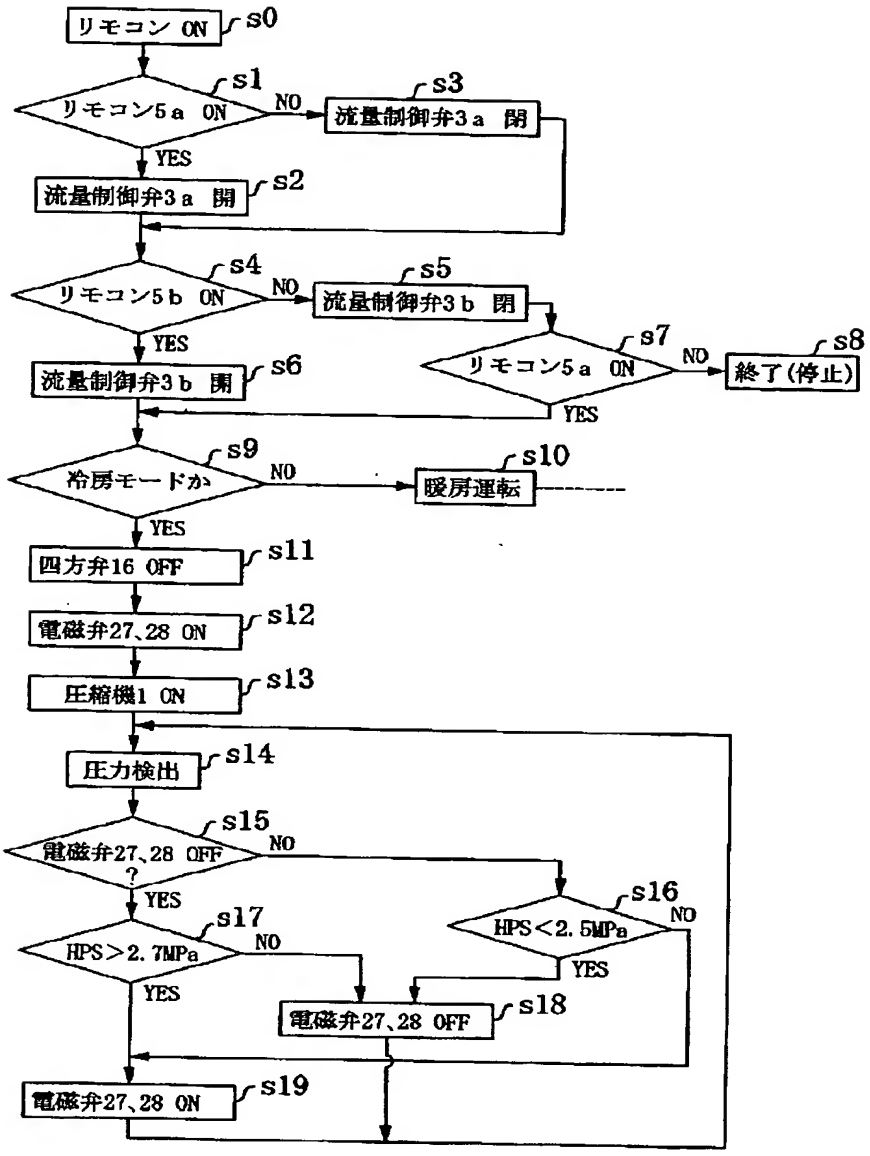
【図２】



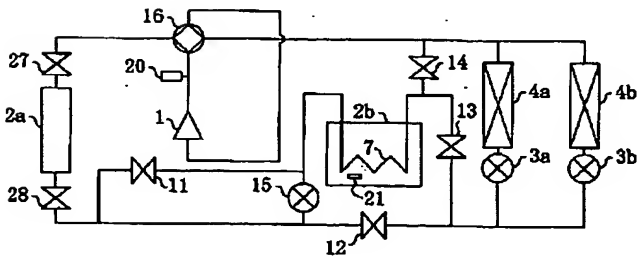
【図６】



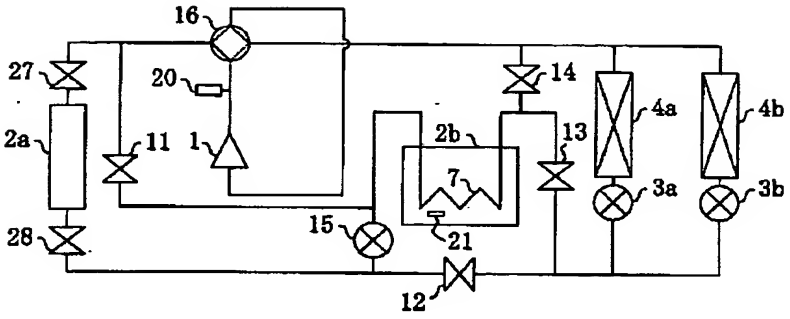
【図３】


リモコン ON
s0
リモコン5a ON
s1
NO
YES
流量制御弁3a 閉
s3
流量制御弁3a 開
s2
リモコン5b ON
s4
NO
YES
流量制御弁3b 閉
s5
流量制御弁3b 開
s6
リモコン5a ON
s7
NO
YES
終了(停止)
s8
冷房モードか
s9
NO
YES
暖房運転
s10
四方弁16 OFF
s11
電磁弁27、28 ON
s12
圧縮機1 ON
s13
圧力検出
s14
電磁弁27、28 OFF
?
s15
NO
YES
HPS＞2.7MPa
s17
NO
YES
HPS＜2.5MPa
s16
NO
YES
電磁弁27、28 OFF
s18
電磁弁27、28 ON
s19

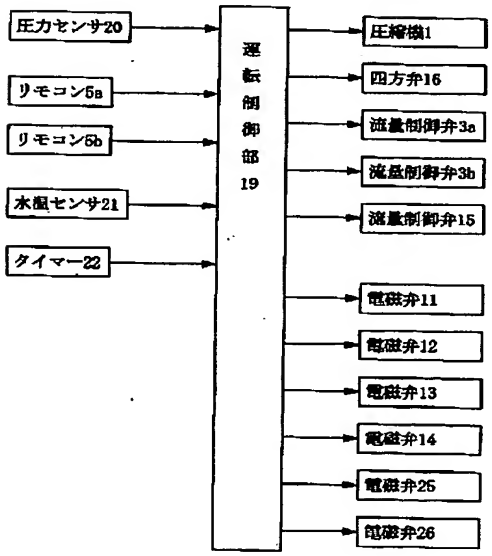
【図８】


16
27
20
14
4a
4b
2a
1
2b
13
7
3a
3b
28
11
15
21
12

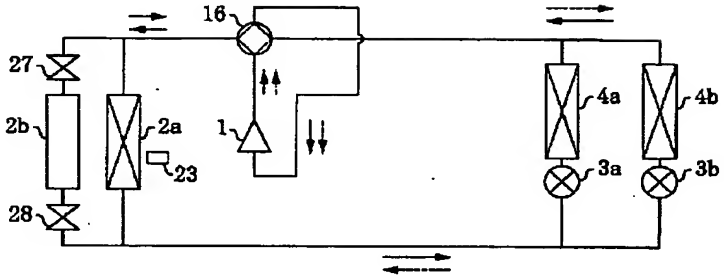
【図４】


16
27
20
14
4a
4b
2a
11
1
2b
13
7
3a
3b
28
15
21
12

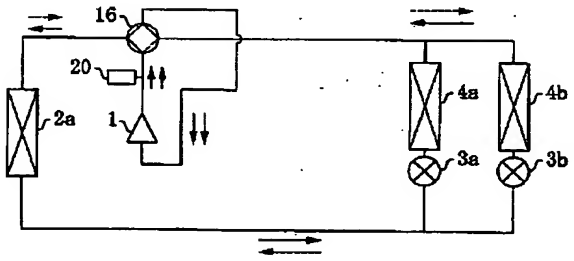
【図５】


圧力センサ20
リモコン5a
リモコン5b
水温センサ21
タイマー22
運転制御部19
圧縮機1
四方弁16
流量制御弁3a
流量制御弁3b
流量制御弁15
電磁弁11
電磁弁12
電磁弁13
電磁弁14
電磁弁25
電磁弁26

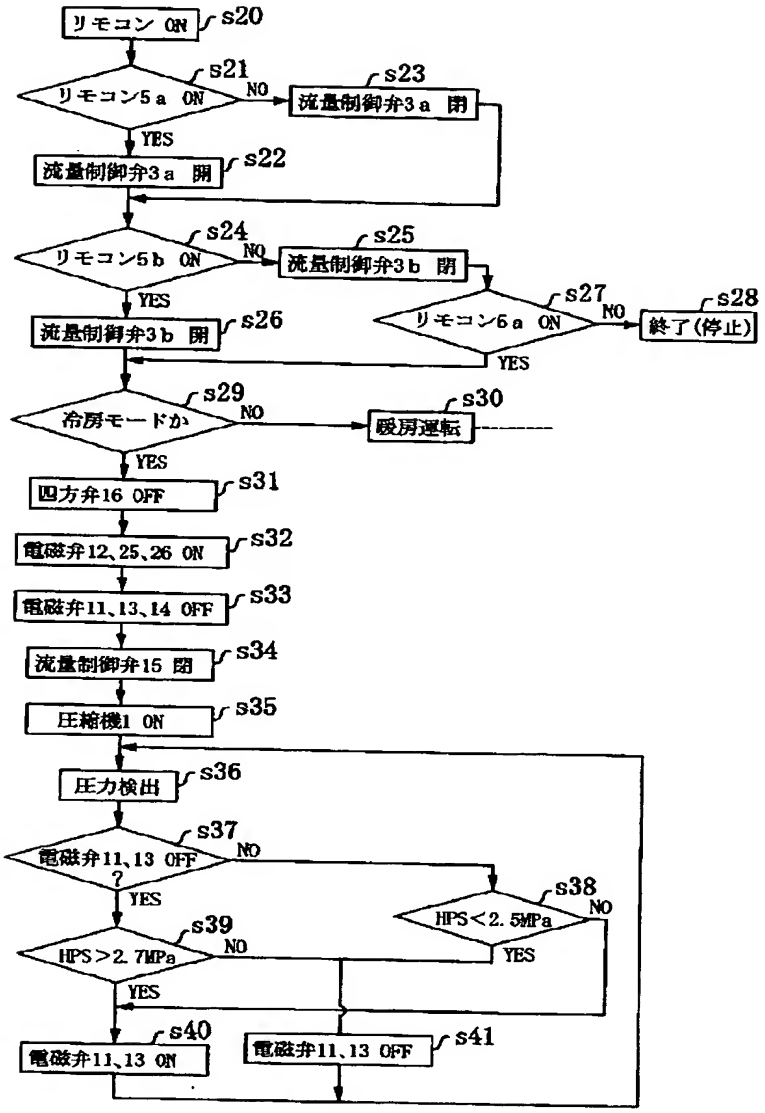
【図１３】


16
27
2b
2a
1
23
28
4a
4b
3a
3b

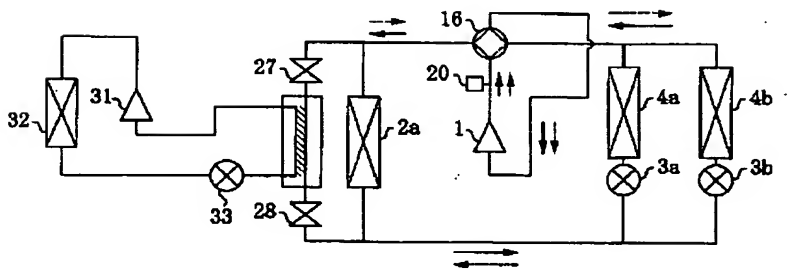
【図１６】


16
20
2a
1
4a
4b
3a
3b

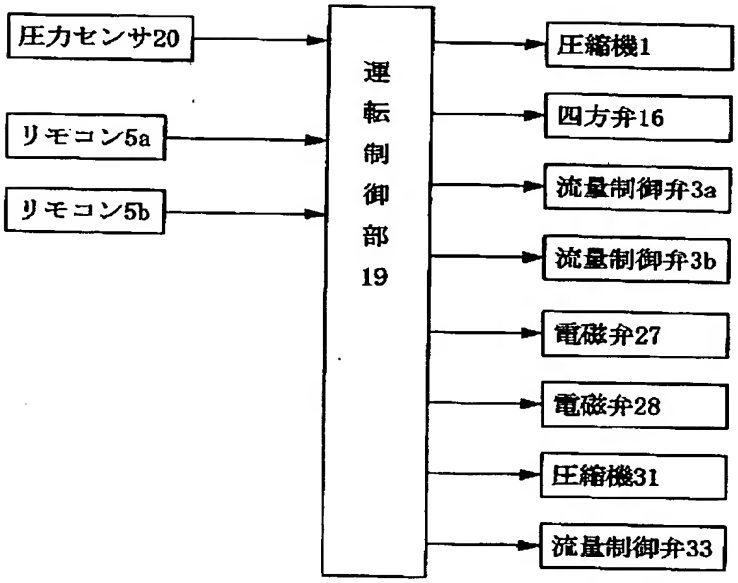
【図７】


リモコン ON
s20
リモコン5a ON
s21
NO
YES
流量制御弁3a 閉
s23
流量制御弁3a 開
s22
リモコン5b ON
s24
NO
YES
流量制御弁3b 閉
s25
流量制御弁3b 開
s26
リモコン6a ON
s27
NO
YES
終了(停止)
s28
冷房モードか
s29
NO
YES
暖房運転
s30
四方弁16 OFF
s31
電磁弁12、25、26 ON
s32
電磁弁11、13、14 OFF
s33
流量制御弁15 閉
s34
圧縮機1 ON
s35
圧力検出
s36
電磁弁11、13 OFF ?
s37
NO
YES
HPS＜2.5MPa
s38
NO
YES
HPS＞2.7MPa
s39
NO
YES
電磁弁11、13 ON
s40
電磁弁11、13 OFF
s41

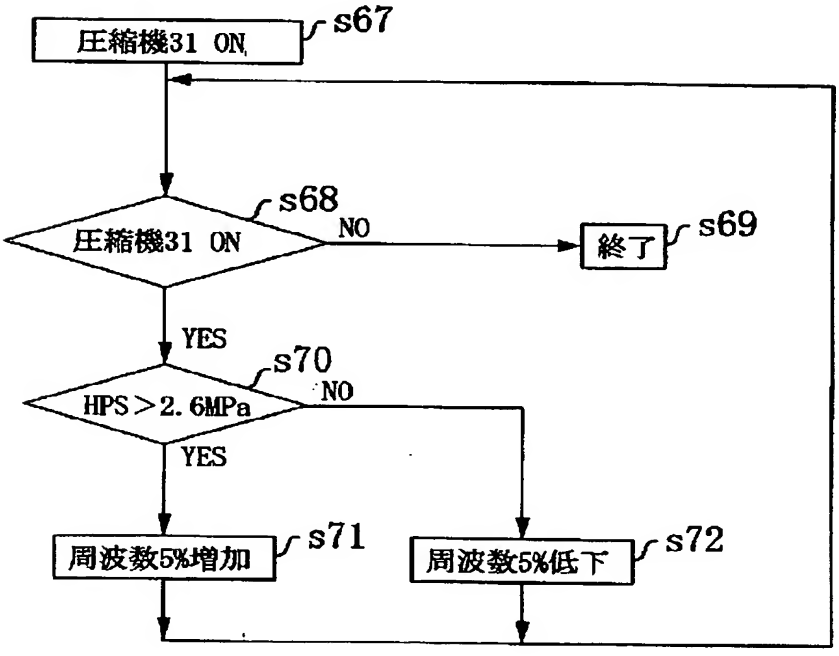
【図９】


16
27
20
31
32
2a
1
4a
4b
3a
3b
33
28

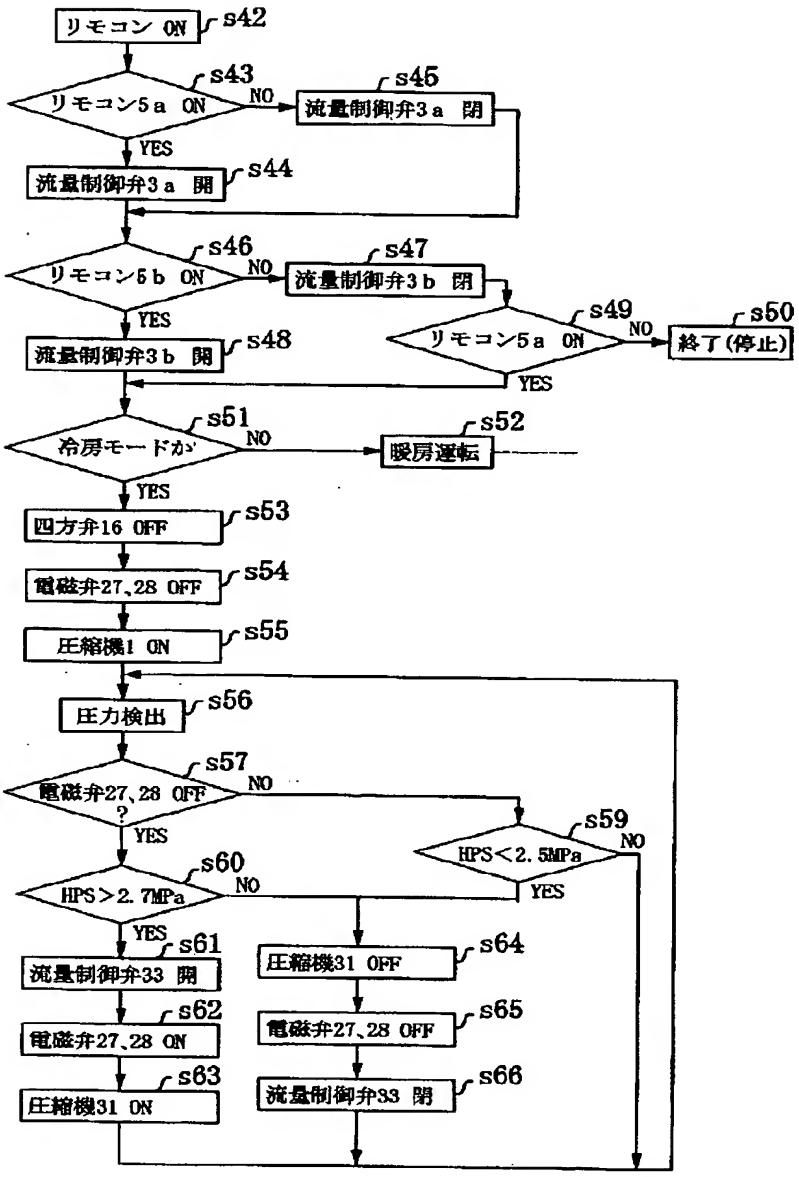
【図１０】


圧力センサ20
リモコン5a
リモコン5b
運転制御部19
圧縮機1
四方弁16
流量制御弁3a
流量制御弁3b
電磁弁27
電磁弁28
圧縮機31
流量制御弁33

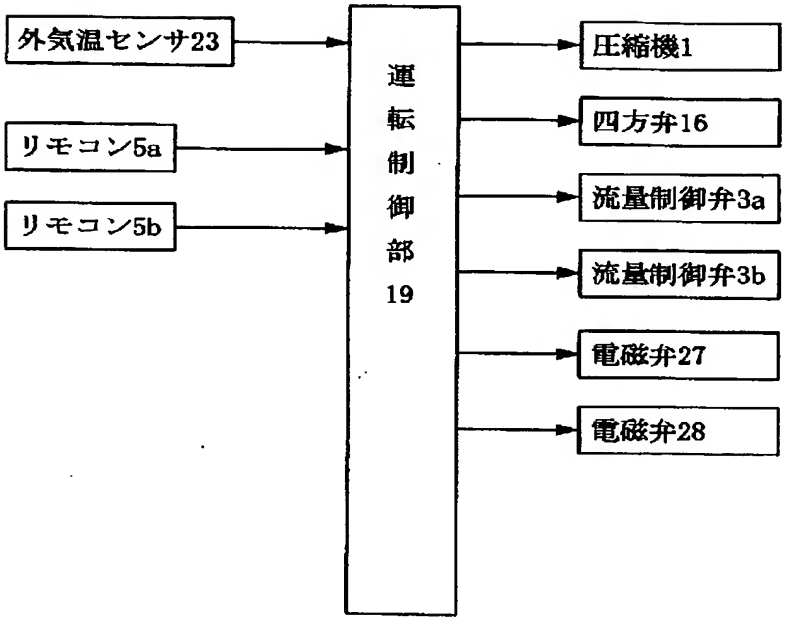
【図１２】


圧縮機31 ON
s67
圧縮機31 ON
s68
NO
終了
s69
YES
HPS＞2.6MPa
s70
NO
YES
周波数5%増加
s71
周波数5%低下
s72

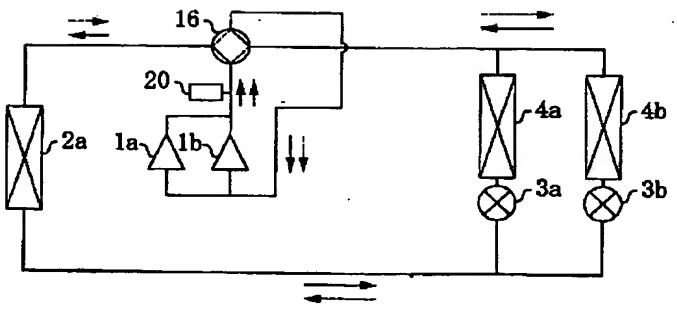
【図１１】


リモコン ON
s42
リモコン5a ON
s43
NO
YES
流量制御弁3a 開
s44
流量制御弁3a 閉
s45
リモコン5b ON
s46
NO
YES
流量制御弁3b 開
s48
流量制御弁3b 閉
s47
リモコン5a ON
s49
NO
YES
終了(停止)
s50
冷房モードか
s51
NO
YES
暖房運転
s52
四方弁16 OFF
s53
電磁弁27、28 OFF
s54
圧縮機1 ON
s55
圧力検出
s56
電磁弁27、28 OFF ?
s57
NO
YES
HPS＞2.7MPa
s60
NO
YES
HPS＜2.5MPa
s59
NO
YES
流量制御弁33 開
s61
電磁弁27、28 ON
s62
圧縮機31 ON
s63
圧縮機31 OFF
s64
電磁弁27、28 OFF
s65
流量制御弁33 閉
s66

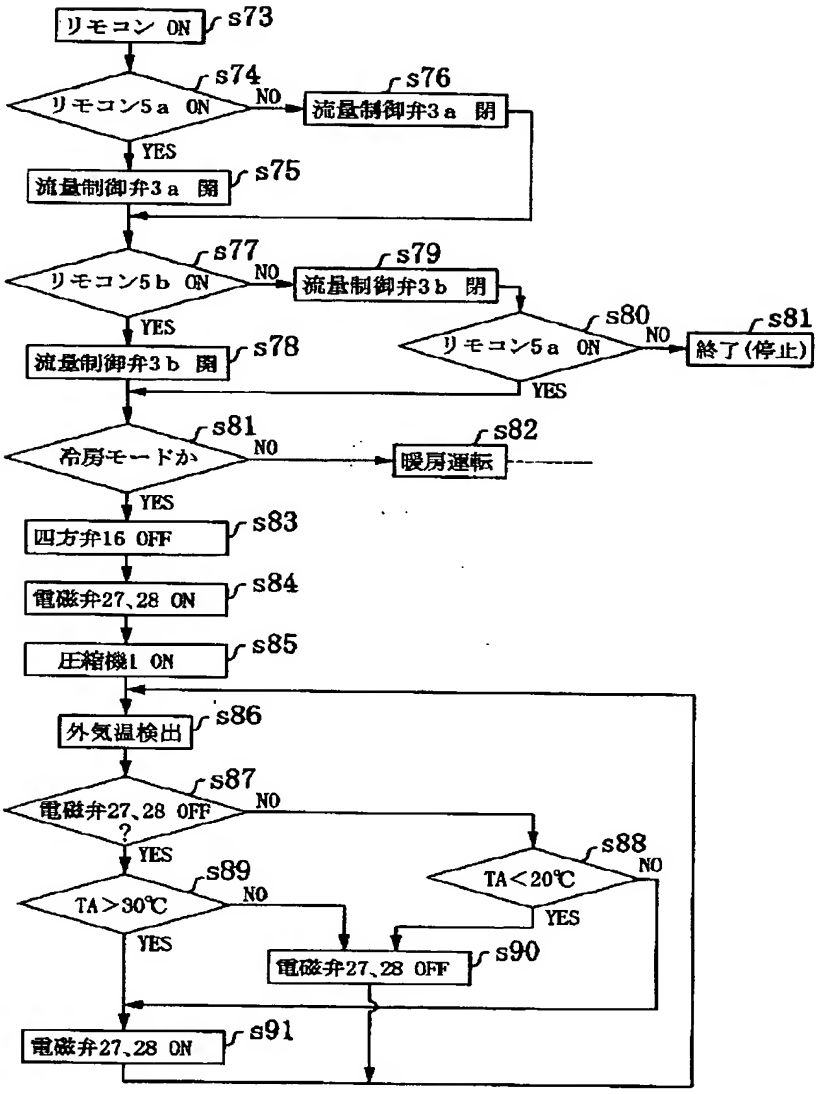
【図１４】


外気温センサ23
リモコン5a
リモコン5b
運転制御部19
圧縮機1
四方弁16
流量制御弁3a
流量制御弁3b
電磁弁27
電磁弁28

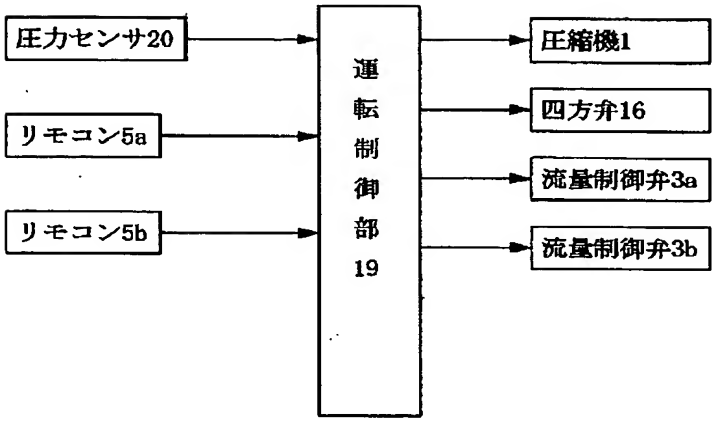
【図１９】


16
20
2a
1a
1b
4a
4b
3a
3b

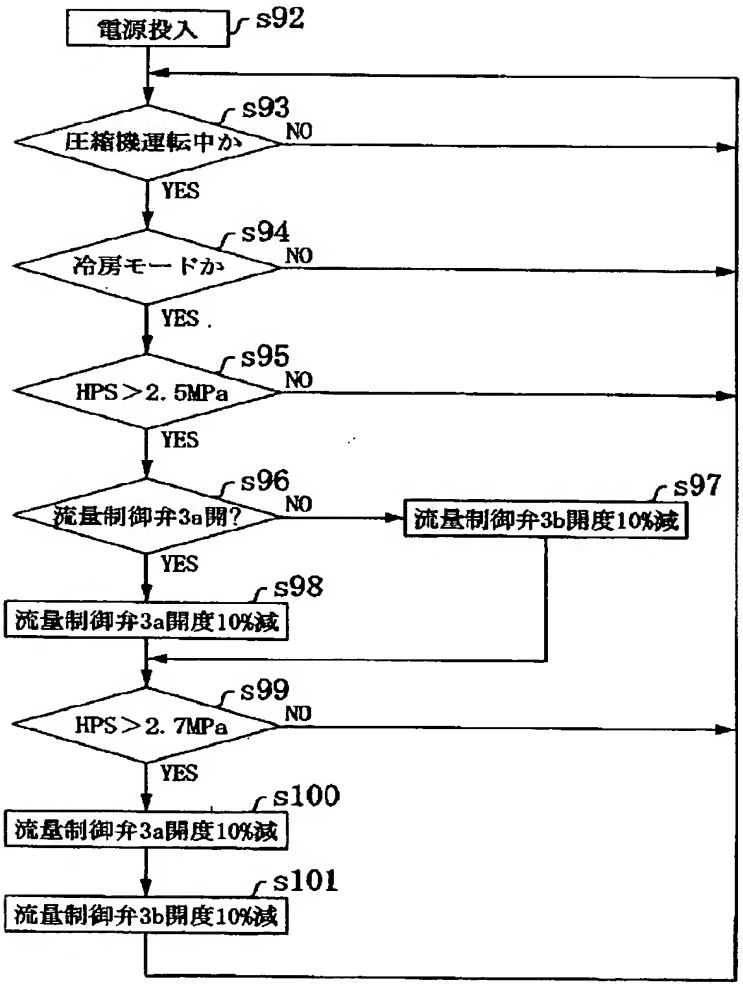
【図１５】


リモコン ON
s73
リモコン5a ON
s74
NO
流量制御弁3a 閉
s76
YES
流量制御弁3a 開
s75
リモコン5b ON
s77
NO
流量制御弁3b 閉
s79
YES
流量制御弁3b 開
s78
リモコン5a ON
s80
NO
終了(停止)
s81
YES
冷房モードか
s81
NO
暖房運転
s82
YES
四方弁16 OFF
s83
電磁弁27、28 ON
s84
圧縮機1 ON
s85
外気温検出
s86
電磁弁27、28 OFF
?
s87
NO
YES
TA＜20℃
s88
NO
YES
TA＞30℃
s89
NO
YES
電磁弁27、28 OFF
s90
電磁弁27、28 ON
s91

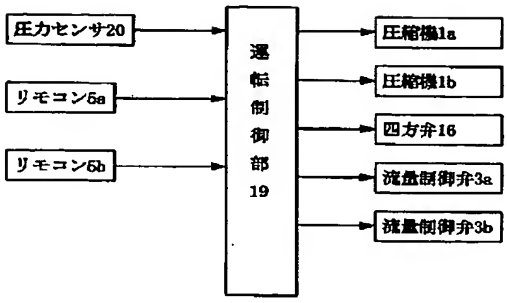
【図１７】


圧力センサ20
リモコン5a
リモコン5b
運転制御部19
圧縮機1
四方弁16
流量制御弁3a
流量制御弁3b

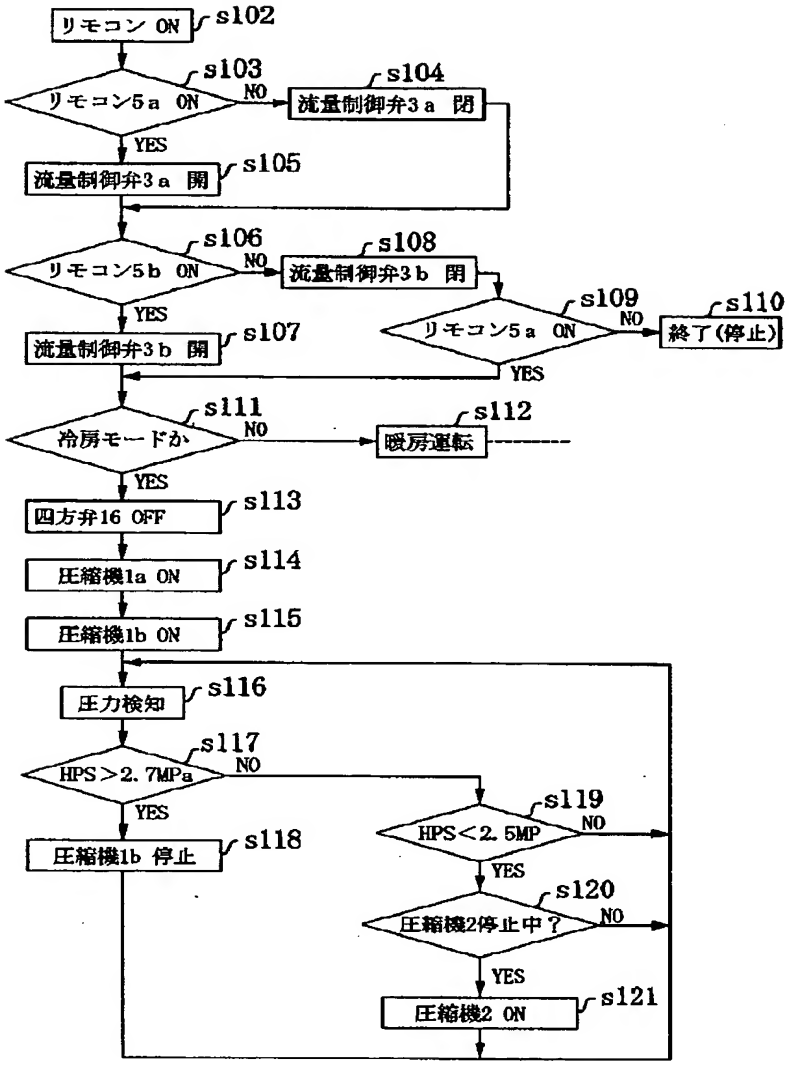
【図１８】


電源投入
s92
圧縮機運転中か
s93
NO
YES
冷房モードか
s94
NO
YES
HPS＞2.5MPa
s95
NO
YES
流量制御弁3a開?
s96
NO
流量制御弁3b開度10%減
s97
YES
流量制御弁3a開度10%減
s98
HPS＞2.7MPa
s99
NO
YES
流量制御弁3a開度10%減
s100
流量制御弁3b開度10%減
s101

【図２０】


圧力センサ20
リモコン5a
リモコン5b
運転制御部19
圧縮機1a
圧縮機1b
四方弁16
流量制御弁3a
流量制御弁3b

【図２１】



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